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Citation for published version:
Fibiger, L 2016, Osteoarchaeological analysis of human skeletal remains from 23 Irish caves. in M Dowd (ed.), *Underground Archaeology: Studies on human bones and artefacts from Ireland's caves.* Oxbow Books, Oxford, pp. 3-37.

Link:
Link to publication record in Edinburgh Research Explorer

Document Version:
Publisher's PDF, also known as Version of record

Published In:
Underground Archaeology

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Download date: 07. May. 2023

AN OFFPRINT FROM

UNDERGROUND ARCHAEOLOGY

Studies on Human Bones and Artefacts from Ireland's Caves

Edited by

MARION DOWD

Hardcover Edition: ISBN 978-1-78570-351-5
Digital Edition: ISBN 978-1-78570-352-2 (epub)

OXBOW | books
© Oxbow Books 2017
Oxford & Philadelphia
www.oxbowbooks.com

Published in the United Kingdom in 2016 by
OXBOW BOOKS
The Old Music Hall, 106–108 Cowley Road, Oxford OX4 1JE

and in the United States by
OXBOW BOOKS
1950 Lawrence Road, Havertown, PA 19083

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Hardcover Edition: ISBN 978-1-78570-351-5
Digital Edition: ISBN 978-1-78570-352-2 (epub)

A CIP record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data

Names: Dowd, Marion, editor of compilation.
Title: Underground archaeology : studies on human bones and artefacts from Ireland's caves / edited by Marion Dowd.
Description: Oxford ; Philadelphia : Oxbow Books, 2017. | Includes bibliographical references.
Identifiers: LCCN 2016047739 (print) | LCCN 2016050657 (ebook) | ISBN 9781785703515 (hardcover) | ISBN 9781785703522 (digital) | ISBN 9781785703522 (epub) | ISBN 9781785703539 (mobi) | ISBN 9781785703546 (pdf)
Subjects: LCSH: Ireland–Antiquities. | Caves–Ireland. | Human remains (Archaeology)–Ireland. | Material culture–Ireland. | Excavations (Archaeology)–Ireland. | Social archaeology–Ireland. | Landscape archaeology–Ireland.
Classification: LCC DA920 .U53 2017 (print) | LCC DA920 (ebook) | DDC 941.5–dc23
LC record available at https://lccn.loc.gov/2016047739

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Printed in Malta by Gutenberg Press
Typeset in India by Lapiz Digital Services, Chennai

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Part I

Human remains

1

Osteoarchaeological analysis of human skeletal remains from 23 Irish caves

Linda Fibiger

The *Human Remains from Irish Caves Project* (HRICP) was initiated by Marion Dowd in 2004, funded by the Heritage Council, and conducted in 2004–2005 (Dowd, Fibiger and Lynch 2005). The main objective of the project was to redress the fact that due to their early discovery, most collections of human bones from caves had either never been scientifically examined or were accompanied by reports with an emphasis on anatomical identification and metric analysis only. Consequently, available data was of a mostly quantitative nature (e.g. Fawcett 1928). The HRICP aim was to analyse the skeletal remains according to current osteoarchaeological standards and create a detailed record of the available material as the basis for further research and comparison (Pl. 1). A total of 24 caves with human bones from 11 counties were identified for analysis or re-analysis (Table 1.1). The project osteoarchaeologist (L. Fibiger) analysed 23 of the assemblages while Linda Lynch examined the Dunmore Cave remains (see Chapter 2); her results are incorporated in the discussion here.

Seven adult teeth from Brothers' Cave, Ballygambon Lower td., Co. Waterford were inadvertently overlooked in the course of the project. The teeth comprise a right mandibular canine (1948:211); a right maxillary molar (permanent, probably M2, 1948:212); a canine (probably right and mandibular, 1948:217); and a mandibular molar (M2, root broken, probably right, 1948:279). The latter was labelled 'Whitechurch Cave' and may have originated from either Oonaglour Cave or Brothers' Cave. Two further molars from Brothers' Cave were direct dated in 2002 and 2010 and both returned Early Bronze Age results (Dowd 2015, 127). The seventh tooth from this site could not be located in 2010.

In 2002, several years prior to the HRICP, 11 bones from the assemblages that formed the basis of the present study were radiocarbon dated (Dowd 2015). These bones are mentioned in the site catalogue here but are not included in the main report which is concerned only with what was available for analysis in 2005. A human femur discovered in a cave at Gorteenroe townland, Co. Mayo in 1980, and deposited in the NMI, could not be located for analysis in 2004 or 2010. An occipital fragment from Knocknarea Cave C, Carrowbunnaun td., Co. Sligo and an adult right upper molar from Coffey Cave (Keash), Cloonagh td., Co. Sligo were destroyed during the dating process; these were the only human bones from these sites and are not discussed further here. Assemblages of human bones from recent excavations at Moneen Cave, Acres td., Co. Clare; Glencurran Cave, Tullycommon td., Co. Clare; Cloghermore Cave, Cloghermore td., Co. Kerry; Annagh Cave, Annagh td., Co. Limerick; Killuragh Cave, Killuragh td., Co. Limerick; and Knocknarea Cave K, Carrowbunnaun td., Co. Sligo, were analysed to osteoarchaeological standards and are excluded from this chapter.

Methodology

The 23 cave assemblages analysed ranged from a few isolated bones to thousands of complete bones and bone fragments. The material was located in the Antiquities Division and the Natural History Division of the National Museum of Ireland, Dublin; the Ulster Museum, Belfast; and the Department of Archaeology, University College Cork, Cork. Osteoarchaeological analysis included identifying, measuring, weighing and recording each bone; calculating the minimum

Table 1.1 Sites included in the Human Remains from Irish Caves Project (HRICP).

	County	*Townland*	*Cave name*
1	Antrim	Ballintoy Demesne	Boat Cave
2	Clare	Ballynahown	Robber's Den
3	Clare	Barntick	Barntick Cave
4	Clare	Cahircalla Beg	Alice and Gwendoline Cave
5	Clare	Edenvale	the Catacombs
6	Clare	Newhall	Bats' Cave
7	Clare	Newhall	Elderbush Cave
8	Cork	Ballymacmoy	Killavullen Cave 3
9	Cork	Castlekevin or Killuragh	Killura Cave
10	Cork	Connaberry	Connaberry Cave C
11	Cork	Connaberry	Main Earth Cave
12	Fermanagh	Legg	Pollthanacarra
13	Kerry	Dunkerron	Dunkerron Cave
14	Kilkenny	Mohil	Dunmore Cave
15	Leitrim	Sramore	Graineater's Cave (Sramore Cave in Dowd 2008; Dowd 2015)
16	Limerick	Knockfennell	Red Cellar Cave
17	Mayo	Unknown	Achill Island Cave
18	Sligo	Cloonagh	Plunkett Cave (Keash)
19	Sligo	Cloonagh	Cave O (Keash)
20	Waterford	Ballinacourty	Quinlan's Quarry Cave
21	Waterford	Ballynamintra Lower	Ballynamintra Cave
22	Waterford	Ballynamintra Middle	Carrigmurrish Cave
23	Waterford	Bridgequarter	Oonaglour Cave
24	Waterford	Kilgreany	Kilgreany Cave

number of individuals (MNI) present; identifying different age groups; identifying different sexes; recording standard osteological measurements; identifying pathologies and anomalies; and identifying taphonomic changes. All human remains were sorted, re-bagged and re-labelled according to anatomical region. A number of the assemblages had not seen extensive handling or analysis since their excavation (typically by antiquarians), making the retrieval of the remains from their crates, snuff boxes and early twentieth century newspaper wrappings almost an excavation in itself. No attempt was made to refit fragments within the larger assemblages as this was beyond the scope of the project. Standard methods were employed throughout (Brickley and McKinley 2004; Buikstra and Ubelaker 1994; Ubelaker 1989).

The vast majority of human remains from the caves studied comprised disarticulated bones and bone fragments and thus it was decided that the most suitable recording system was the zonation method adapted from systems devised by Dobney and Rielly for faunal remains (Dobney and Rielly 1988; Knüsel and Outram 2004; CD Appendix 1: Fibiger). Rather than creating lengthy descriptions for each bone or bone fragment, anatomical elements are divided into several numbered zones that are defined by drawings and a written description. This method is particularly suited for the detailed investigation of taphonomic changes and fragmentation patterns. Each bone or bone fragment was recorded according to zones present, even if a particular zone is only partly preserved (CD Zonation diagrams). In addition, each bone fragment is identified to side. Unidentifiable fragments are divided by size and recorded according to whether they belong to the axial skeleton (includes cranium, mandible, vertebrae, hyoid, manubrium, sternum, ribs) or appendicular skeleton (includes arms, hands, shoulders, pelvis, legs, feet). Fragments that could be identified to element level (e.g. cranium, humerus, femur etc.) but not to a particular zone were recorded as 'General cranium', 'General humeral diaphysis' etc. The definitions for each zone were adapted from work by Knüsel and Outram (2004).

The palaeopathological examination of disarticulated and fragmented remains for diseases and injuries presents a particular challenge. Skeletal changes or anomalies seen on isolated specimens preclude the consideration of patterns of pathological changes distributed throughout the skeleton, or the opportunity to compare the size and shape of bilateral elements to identify anomalies. As a result, some of the pathological skeletal changes noted during analysis could only be tentatively attributed to a wider disease category. As the same pathological conditions were sometimes found in a number of assemblages, a brief summary of recordable characteristics of different pathological changes is given here.

Dental disease

Recording of overall tooth wear for complete or partial dentitions as well as tooth wear of individual teeth was based on the grading system by Brothwell (1981, 72) and noted as slight, moderate or severe. Each tooth was also examined for the presence of calculus, a mineralised plaque deposit, and deposits were graded for each tooth as slight, moderate or severe (*ibid*., 55). Caries varies in appearance from discoloration of the enamel surface to large cavities and is the combined result of bacterial activity and the presence of carbohydrates and food sugars. All teeth were examined for its presence. Dental abscesses are caused by infections, either as a result of the exposure of the pulp cavity or root of a tooth to bacteria or secondary to the occurrence of periodontal disease. Eventually, this increasing pressure results in a characteristic sinus (hole) in the bone which

allows the pus to drain (Roberts and Manchester 1995, 50). The presence of a dental abscess was scored when evidence for a draining sinus was present. Ante-mortem tooth loss was identified when an observable tooth socket had been partially or completely filled in with newly formed bone. Finally, hypoplastic enamel defects can occur as lines, grooves or pits on the enamel of a tooth. They are the result of episodes of nutritional, pathological, physiological or psychological stress during enamel formation, resulting in growth disturbances recognisable as lines, grooves or pits on the enamel surface (Hillson 1996, 165). The presence or absence of enamel hypoplasia was recorded for each tooth.

Degenerative joint disease (DJD)

Degenerative joint disease is the result of wear and tear of the bone and soft tissue components of a joint throughout life. Although it is primarily age-related, in some cases it can have an inflammatory origin or occurs secondary to trauma or other pathological conditions that alter the mechanics or strength of a joint (Rogers and Waldron 1995). The changes associated with DJD, which are visible on the bone, are the immediate result of wear and tear of joint tissue, especially joint cartilage. They include porosity (pitted appearance of a joint surface), osteophytes (bony growth around the margin of a joint), eburnation (polishing of an area of the joint surface), and joint contour change (changes in the size or profile of the joint), which were recorded for each joint surface where present.

Metabolic disease

Metabolic diseases are often the result of a deficiency of one or several essential nutrients. This deficiency can result in nutritional stress and adversely affect maintenance of soft tissue as well as development and maintenance of bone. *Cribra orbitalia* describes changes to the orbital roof, visible as increased porosity and thinning of the outer layer of the bone. In the past these changes have been regarded as pathognomonic of acquired iron-deficiency or anaemia, but in recent years the term has attained a more descriptive function (Ortner pers. comm.). Some of the numerous factors that can contribute to iron deficiency and anaemia, apart from dietary deficiencies, are physiological processes within the body that can cause inadequate iron absorption, excessive bleeding and gastrointestinal infections (Stuart-Macadam 1991, 105; Ortner 2003). Each preserved orbit was examined for the presence of *cribra orbitalia* lesions, which were scored based on the system of Stuart-Macadam (1991, fig. 9.3a).

Infectious disease

Changes related to infectious conditions noted on skeletal remains are the result of more chronic diseases that the individual survived for weeks, months or even years. These conditions can be divided into specific and non-specific infections. Skeletal changes resulting from infectious conditions are either lytic (reduction of bone tissue) or proliferative (additional bone tissue is laid down). Assessing the distribution pattern of new bone formation across the skeleton is essential for recognising different diseases. Isolated or unilateral lesions have to be distinguished from bilateral or multi-focal changes that indicate the presence of a systemic rather than a localised condition. As this is not possible when analysing disarticulated and fragmented remains, only a more general diagnosis of skeletal changes related to infection was possible.

Trauma

Fractures can occur either as primary injuries, secondary to pathological conditions that reduce the mechanical strength of a bone, or as stress fractures after periods of repetitive mechanical stress. Occasionally, inflammation, irritation or micro-trauma to muscles, tendons or ligaments will also result in changes visible on the skeleton (Pavlov 1995, 3246). Each fracture or connective tissue injury was assessed with regard to appearance, possible origin (including whether the trauma was likely to be accidental or violence related) and degree of healing.

Size of the assemblages

One of the most obvious and striking features of the assemblages of human bones from caves is the variation in the number of elements present and overall weight, ranging from an isolated bone fragment from Cave O, Keash, to an assemblage weighing in excess of 18kg from Kilgreany Cave (Figs. 1.1 and 1.2). Exceptions in weight like Killavullen Cave 3 and Carrigmurrish Cave are the result of the presence of substantial calcite deposits adhering to the remains (Pls. 3 and 4), which add considerably to the overall weight.

Minimum number of individuals (MNI)

Closely linked to the inventory of fragment numbers and weight (Figs. 1.1 and 1.2) is the MNI count for each site (Table 1.2). To calculate the MNI represented by the disarticulated skeletal remains from each cave, the total number of diagnostic zones present for the cranium, mandible, shoulder and long bones in each age group (adult, juvenile/adolescent, infant) were assessed. Even zones that are only partly preserved will be recorded as 'present' through the zonation method. This might result in a slight overestimation of MNI, especially when considering long bone fragments. The MNI calculations, therefore, mostly relied on the number of zones including joint surfaces. A more detailed assessment of the MNI of

different age groups within the juvenile/adolescent sample proved to be difficult, especially for the Kilgreany Cave assemblage. Unlike the clear division between skeletally mature (i.e. adult) individuals and non-adults, ageing juveniles and adolescent remains based on isolated bones has to rely on assessing relative size and development on a rather less clear-cut, continuous scale. It was, therefore, decided to use very broad age categories (neonate/infant, juvenile/adolescent), but list elements that had been aged more precisely to indicate sub-groups within these categories.

In the smaller assemblages, one single bone can represent at least one individual or the presence of a certain age group. For larger assemblages, detailed inventories of the total number of diagnostic zones for the cranium, mandible, shoulder and long bones in each age group (adult, juvenile/adolescent, infant) had to be conducted. MNI was then based on the most frequently counted diagnostic zone in each age group.

Over half the cave assemblages were only represented by one individual; with one exception these individuals were all adults (Table 1.2). All of these sites had very small overall fragment counts of between one and 18 bones. A further nine sites gave an MNI of between two and four individuals, with seven sites including adult as well as

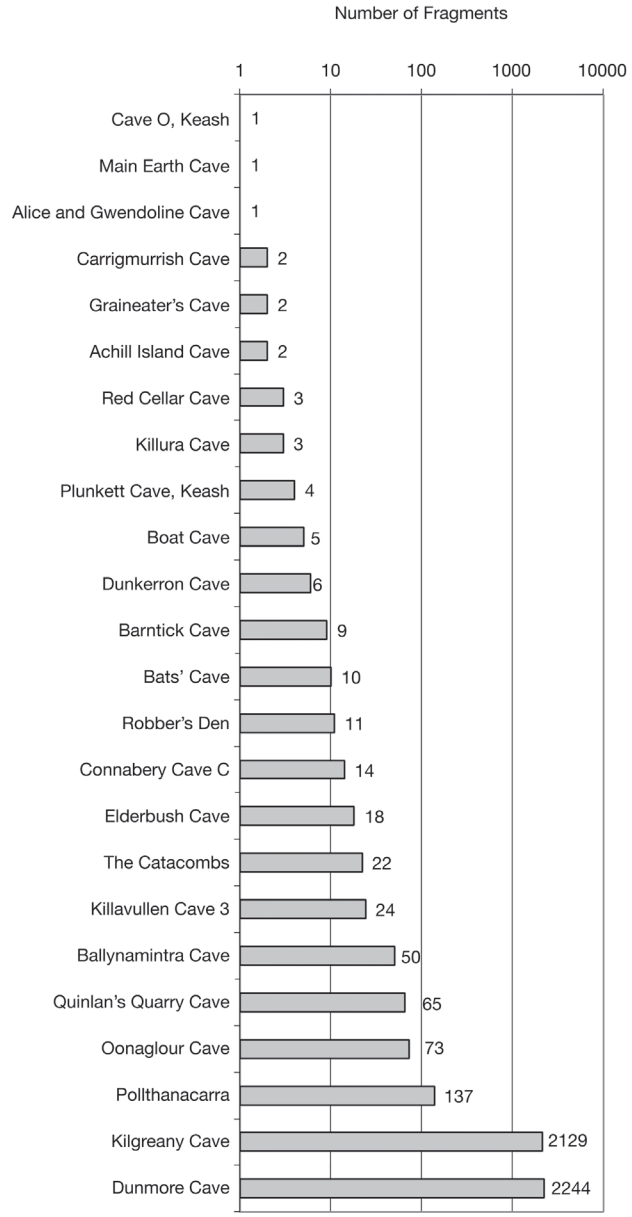

Figure 1.1 Number of human bones and bone fragments recorded from each cave.

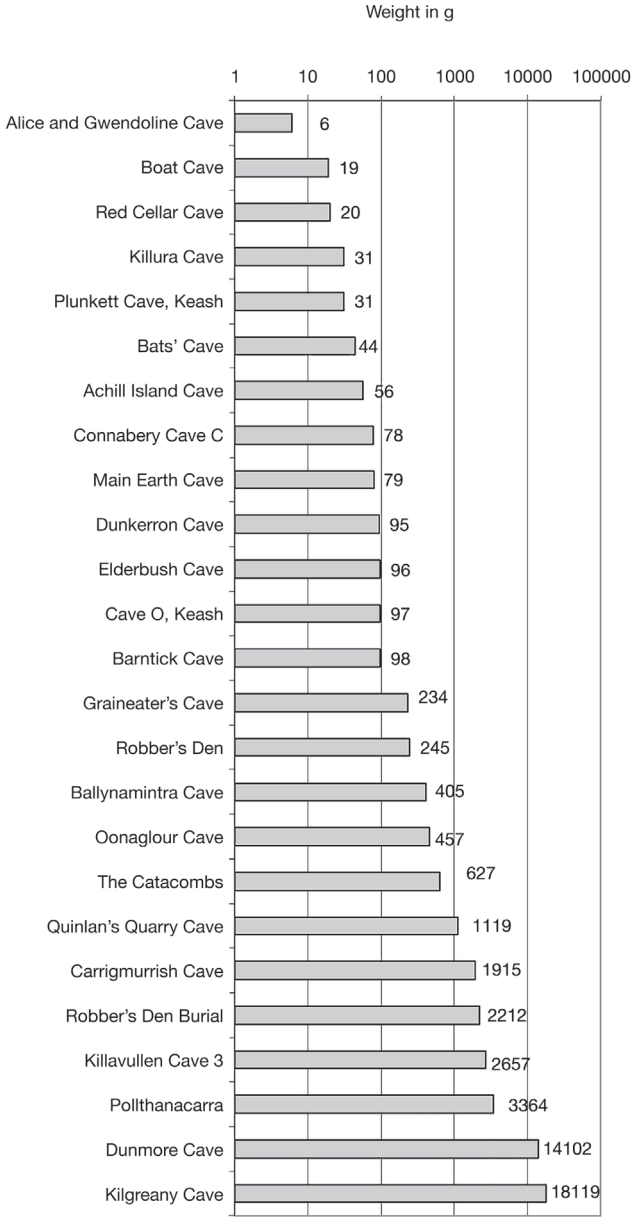

Figure 1.2 Total human bone weights (in grammes) from each cave.

non-adult remains. Fragment count in this group ranged from three to 173 bones, but included mostly the more substantial of the smaller assemblages. Unsurprisingly, the MNI for the two largest assemblages – from Kilgreany Cave and Dunmore Cave – was considerably higher and included adult as well as non-adult remains. Although at some sites the MNI present was calculated as just one overall, or one within a particular age group, it is important to keep in mind that the MNI is just that – a *minimum* number that may well have been higher.

Age and sex

Neonates and young infants were aged by recording long bone length where possible (Scheuer *et al*. 1980), whereas ageing of juveniles and adolescents was based on observing dental calcification, growth and eruption (Ubelaker 1989, fig. 71; Smith 1991; Scheuer and Black 2000). After skeletal maturity in the mid-20s, age-assessment is mostly based on recording degenerative changes. Depending on the skeletal element present, adult age assessment was based on observing the final stages of epiphyseal fusion and dental eruption (third molar) in early adulthood as well as recording other degenerative changes that take place throughout life. Where possible, the stages of fusion of the medial clavicle and iliac crest (Webb and Suchey 1985) were observed to distinguish young adults from older individuals, whereas pelvic remains of middle adult and mature individuals were aged based on morphological changes of the auricular surface of the ilium (Lovejoy *et al*. 1985) – if these elements were present and observable. As preservation was frequently insufficient, elements could mostly only be classified as 'adult' based on size and robusticity.

It should also be noted that some of the non-articular fragments present recorded as 'adult' might possibly belong to older adolescents. However, without being able to assess stages of epiphyseal fusion, any bone fragments robust enough to belong to adults were classed as such. Age categories used here are as follows:

Foetus	<38 foetal weeks
Neonate	Around the time of birth (≤1 month)
Infant	<1 year
Juvenile	1–12 years
Adolescent	13–17 years
Young Adult	18–25 years
Young Middle Adult	26–35 years
Old Middle Adult	36–45 years
Mature Adult	45+ years
Adult	>17 years

Only in cases where femoral or humeral head size appeared to be either noticeably smaller or larger than existing standards, was sex ascribed as female, possibly female, male, or possibly male. To sex adult skeletal elements up to ten morphological features of the pelvis and 13 morphological features of the skull and mandible were observed. These were scored as male, possibly male (male?), female, possibly female (female?), or indeterminate, resulting in a final composite score based on all observable traits (Buikstra and Ubelaker 1994, 16; after Herrmann *et al*. 1990, 73) (Table 1.3).

The fact that age brackets for adult age assessment are wider in general makes ageing of disarticulated remains even less specific. Most adult age groups (young, young middle and old middle adult) appeared to be present throughout the cave assemblages. Accurate age assessment for adult

Table 1.2 Minimum number of individuals (MNI) by site.

Site	*MNI Adult/ Adolescent*	*MNI Juvenile*	*MNI Infant*	*MNI total*
Boat Cave			1	1
Robber's Den*	3	1		4
Barntick Cave	1			1
Alice and Gwendoline Cave	1			1
The Catacombs	2	1		3
Bats' Cave	1	1	1	3
Elderbush Cave	1			1
Killavullen Cave 3	2			2
Killura Cave	1			1
Connaberry Cave C	1			1
Main Earth Cave	1			1
Pollthanacarra	4			4
Dunkerron Cave	1			1
Dunmore Cave	18	14	11	43
Graineater's Cave	1			1
Red Cellar Cave	1	1		2
Achill Island Cave	1			1
Plunkett Cave, Keash	1			1
Cave O, Keash	1			1
Quinlan's Quarry Cave	2	1		3
Ballynamintra Cave	2	1		3
Carrigmurrish Cave	1			1
Oonaglour Cave	1	1		2
Kilgreany Cave	15	3	3	21

**The Robber's Den MNI includes the bones of a partial burial, which was not included in the overview of the number of fragments present.*

bones from Kilgreany and Dunmore was rarely possible, but included young and middle adults. Adult sex assessment at the sites summarised in Table 1.3 appears to be slightly biased towards males, though at both Dunmore Cave and Kilgreany Cave a larger proportion of sexed bones appear to belong to females. This, however, could be related to the fact that remains are more likely to be classified as female if pronounced sexual dimorphism is absent in the host population, rather than being the result of a real bias during deposition of remains.

There is a general paucity of non-adult bones when considering the total number of assemblages studied. Although non-adult bones are present at ten of the 24 caves, remains mostly consist of single or very few bones and fragments, even in caves where the majority of anatomical regions were represented of adult remains (see Robber's Den, Quinlan's Quarry Cave, Ballynamintra Cave and Oonaglour Cave). This appears to indicate that burial or deposition of human skeletal remains in caves was subject to an age bias. Dunmore is unusual in this regard as more non-adult than adult fragments were found at the site. As no difference in the spatial distribution pattern between adult and non-adult remains was noted, it is possible that the activities practised at Dunmore were deemed suitable for individuals of all ages. Interestingly, Boat Cave is the only site that yielded exclusively non-adult remains. The bones from this cave comprised cranial remains of a neonate or very young infant in good condition. Considering different age groups throughout the assemblages, there appears to be a bias towards younger juveniles (under six years) and neonates/young infants. This trend might reflect ritual practice, but is as likely to be the result of higher mortality rates in this age group due to the frequent occurrence of childhood diseases in younger juveniles as well as susceptibility of infants to gastro-intestinal infections and other pathological conditions (Stuart-Macadam 1995).

In order to record the physical characteristics of the skeletal remains from each cave, sets of measurements based on the standards in Buikstra and Ubelaker (1994) were taken on those skeletal elements that were sufficiently preserved. The majority of these are adult measurements, though maximum length measurements of the long bones of non-adult remains were recorded whenever possible. Due to the fragmented nature of the remains, very few measurements could be taken. Length measurements of complete long bones were included in each site-specific entry, and in the case of adult bones, sex assessment of long bones was carried out whenever possible. Stature of sexed adult long bones was calculated based on the regression formulae developed by Trotter (1970). A small selection of non-metric traits was scored on various skeletal elements, but as the remains from each cave did not necessarily represent population groups and the number of observable traits was small, this data was not further analysed.

Table 1.3 Overview of elements and methods used for age and sex assessment.

Site	*Element*	*Age*	*Sex*	*Morphology/ development*	*Metrics/ general size*
Boat Cave	Cranium	Neonate/ Young Infant	–	X	X
Robber's Den burial	Skull	> 35 years	Female	X	
Barntick Cave	Occipital	Adult	Male?	X	
The Catacombs	Cranium	Adult	Male	X	
	Radius, Ulna, Fibula, Metatarsals	Juvenile > 3years	–	X	X
Bats' Cave	Scapula, Rib, Tibia	Juvenile > 3 years	–	X	X
	Vertebrae	Infant	–	X	X
Pollthanacarra	Femur	Adult	Male		X
	Femoral head	Adult	Male		X
	Femoral head	Adult	Female		X
Graineater's Cave	Mandible	> 20 years	Male	X	
Quinlan's Quarry Cave	Os coxae	18-25 years	Female	X	
	Femoral head	Adult	Male	X	X
	Vertebrae	Juvenile 5+ years	–	X	X
Ballynamintra Cave	Metatarsals	Juvenile <10 years	–	X	X
Carrigmurrish Cave	Skull	26–45 years	Male	X	

Representation of anatomical regions

When considering the representation of different body parts across all caves, those sites with larger numbers of bone fragments naturally tend to cover a greater number of anatomical elements (Table 1.4). The most frequently noted element is the cranium, followed by the mandible, spine and ribs. The importance and special treatment of the head in ceremonial contexts, during Irish prehistory in particular, has previously been noted (Cooney and Grogan 1999, 146), and ethnographic parallels further illustrate this idea, whereas in later historic Ireland, the collection and display of skulls becomes a means for punishment and intimidation (Ó Donnabháin and Cosgrave 1994). The importance of the head could have resulted in especially careful treatment and a greater likelihood of formal deposition of the skull in cases of excarnation and exposure. Although complete or partial crania were present at Carrigmurrish Cave, the Catacombs, Boat Cave, Kilgreany Cave and Dunmore Cave, the majority of cranial remains consisted of cranial vault fragments. The more fragile bones of the facial skeleton were virtually absent, which is most likely linked to taphonomy and differential survival.

Long bones of the arms and legs were present in all of the more substantial assemblages (15+ fragments). However, the smaller bones of the hand and feet as well as more fragile elements such as vertebrae and ribs were also frequently represented. An inventory of the minimum number of individuals based on any of the latter usually does

Table 1.4 Distribution of anatomical elements across all cave sites.

Site	*Cranium*	*Mandible*	*Clavicle*	*Scapula*	*Vertebrae*	*Sternum*	*Ribs*	*Pelvis*	*Humerus*	*Radius*	*Ulna*	*Hand*	*Femur/Patella*	*Tibia*	*Fibula*	*Foot*
Boat	j															
Alice & Gwendoline			A													
Barntick	A	A									A	A	A			
Bats'				A/j			j			A				j		
Elderbush			A		A		A	A			A	A		A	A	A
Robber's Den	A	A/j		A	A		A		A				A	A		
Catacombs	A				A		A	A	A	A/j	A/j	A/j			J	A/j
Connaberry Cave C	A	A		A	A							A				A
Killavullen Cave 3					A		A	A			A		A	A	A	A
Killura	A								A			A				
Main Earth														A		
Pollthanacarra	A	A		A	A			A	A	A	A	A	A	A	A	A
Dunkerron					A		A			A						
Dunmore	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j
Graineater's		A							A							
Red Cellar							j									
Achill Island	A	A														
Cave O, Keash														A		
Plunkett Cave, Keash	A	A							A							
Quinlan's Quarry	A			A	A/j		A	A	A	A	A	A	A		A	A
Ballynamintra	A	A	A		A		A		A	A	A	A	A		A	A/j
Carrigmurrish	A	A														
Kilgreany	A/j	A/j	A/j	A/j	A/j	A	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j	A/j
Oonaglour	A	A	A	A			A	A	A	A	A	A	A/j	A		A
TOTAL	15	12	6	8	12	2	12	8	11	9	10	11	9	10	7	10

A = Adult; j = Juvenile/Non-adult; Light grey = Adult remains only; Dark grey = Includes juvenile remains.

not necessarily reflect the minimum number of individuals calculated from other parts of the skeleton. However, their presence indicates that if bodies were exposed or previously buried elsewhere and then brought to a cave, great care was taken to collect and preserve even the smallest elements. At the same time, if caves were used as sites for excarnation or exposure, with bones being collected and deposited elsewhere at a later stage, there appeared to be no particular preference towards collection of certain anatomical elements, though smaller elements might have been more easily missed during any collection process.

Alternatively, the presence of a large variety of anatomical regions can be interpreted as supporting the idea that fleshed bodies rather than bones only were brought to some caves. At least four sites – Robber's Den, Pollthanacarra, Dunmore and Kilgreany – produced evidence for partially articulated human remains, and it is possible that the larger assemblages in this study result from the deposition of complete bodies that were subsequently disturbed by environmental processes, human activities or animal activities. In this context it should be noted that while no unambiguous skeletal evidence for excarnation, such as defleshing cutmarks, was recorded in the assemblage, this certainly does not mean that excarnation did not take place.

A number of assemblages included the majority of, or virtually all, anatomical regions (Robber's Den, the Catacombs, Elderbush Cave, Pollthanacarra, Dunmore Cave, Quinlan's Quarry Cave, Ballynamintra Cave, Oonaglour Cave and Kilgreany Cave), and all of these sites had MNI counts greater than one. When comparing the MNI with the overall weight and total number of fragments present at these sites, however, it becomes clear that the respective quantities of bone do not even come close to the figures expected for the number of individuals present. An adult human skeleton usually weighs between 2,000g and 3,500g (McKinley 2000). Even when considering the large assemblages from Kilgreany and Dunmore, their overall bone weight comes to less than half of the expected figure. A closer look at the weight distribution of different anatomical regions at these two substantial assemblages also reveals that skull remains are slightly over-represented at both sites (Table 1.5).

Table 1.5 Kilgreany Cave and Dunmore Cave: comparison of percentage weight (after McKinley 1989).

Area of skeleton	*Expected % of total weight*	*Kilgreany Cave % of total weight*	*Dunmore Cave % of total weight*
Skull (cranium and mandible)	18.2%	24.7%	22.8%
Axial skeleton (vertebrae, sternum, ribs, shoulders, pelvis)	23.1%	18.5%	31.2%
Upper limb (humerus, radius, ulna, hand)	20.6%	14.5%	16.9%
Lower limb (femur, patella, tibia, fibula, foot)	38.1%	42.3%	29.1%

The axial skeleton is over-represented at Dunmore, whereas the upper limb is under-represented at both sites. The lower limb is under-represented at Dunmore, whereas the figure for Kilgreany lies slightly above the expected value. It is difficult to explain the exact processes behind these figures. It should be borne in mind that both sites have suffered disturbance and Dunmore has seen extensive removal of skeletal remains over the years (Dowd 2002; Dowd 2015, chapter 2; Dowd, Lynch and McCarthy 2007), so neither can be considered a complete collection of the human remains originally deposited at the sites – as is the case for all of the cave assemblages discussed here. The slight overrepresentation of skull remains at both sites again seems to underline the importance of this part of the body during deposition and burial. However, this may also reflect the collection of more easily recognisable elements by antiquarians, especially in the case of Dunmore Cave. In order to explain the general discrepancy between MNI and expected bone weight characterising all assemblages, however, it is necessary to consider taphonomic factors as well as ritual behaviour.

Taphonomic changes

In order to assess the pattern of taphonomic changes resulting from human interference, animal scavenging and exposure in each assemblage, every bone and bone fragment was examined for the following features, which were mostly scored as absent or present: breaks present; broken while still 'wet' or already 'dry'; morphology of breaks present; animal activity; staining; adhering calcite deposits (Pl. 4); surface erosion; cracking/flaking; scorching/burning (Pl. 5) and cutmarks associated with defleshing. Generally, the condition of the bones from most sites was moderate to good. Only in one case, at Oonaglour Cave, post-excavation treatment of the remains included washing and boiling them in a glue mixture, rendering the bones poorly preserved with an almost friable consistency. Almost all of the assemblages showed some evidence for taphonomic changes that had affected the remains in the burial or depositional environment (Table 1.6). These ranged from small areas of staining, cracking or flaking of the cortex and adhering calcite deposits, to substantial surface erosion and total encasing of the bone with calcite (Pls. 3 and 4).

Evidence for scavenging or rodent activity was minimal, and only two possible and one definite case were recorded (Ballynamintra Cave, Kilgreany Cave and Dunmore Cave).

At the same time, the widespread presence of calcite throughout all the assemblages appears to indicate that at least a proportion of the remains were exposed on cave floors for some time rather than buried. Although the majority of caves would have been relatively accessible, and open exposure on cave floors would make bodies or bones easy prey for scavengers, it appears that scavenging or gnawing has not visibly affected the remains. This is interesting considering that the majority of caves in this study yielded various quantities of animal bone, ranging from small rodents to large mammals. Deposition of fleshed human bodies, body parts or 'wet' bones would have resulted in a greater likelihood of scavenging compared to the deposition of 'dry' bones (Haglund 1997). Accessibility and behavioural patterns of scavenging rodent and mammal species also have to be taken into consideration and an absence of scavenging marks on the human bones themselves might simply indicate that a complete anatomical element was removed for consumption elsewhere or completely digested on site and redeposited in scats at another location (Carr and Knüsel 1997; Haglund 1997). At present it appears that the most likely effect of animal activity in the caves under study would have been an increase in disarticulation, dispersal and breakage of bones. There is a high susceptibility of exposed human remains to disarticulation and displacement once soft tissue has decomposed, and this type of damage could have been enhanced by human activities and through other mechanisms such as localised flooding and extreme temperature changes (Lyman 1994, 381; Weiss-Krejci 2012). Bones could also have been deliberately removed in antiquity for a variety of practical or ritual-related reasons, or may have been taken away as souvenirs by more recent visitors to caves.

The vast majority of breaks seen on the remains are dry bone breaks, which occurred after a considerable post-mortem interval and decay of a proportion of the collagen content of the bones. Sediment pressure and trampling are the most likely causes for this and again emphasise the potential impact of animal or human activity in the caves on preservation, disarticulation and completeness of the assemblages. Some of the fresher-looking breaks are probably the result of excavation and curation damage. At three sites (the Catacombs, Oonaglour Cave and Kilgreany Cave), breaks were noted that appeared to have occurred

Table 1.6 Overview of taphonomic changes present at different cave sites.

Site	*Animal activity*	*Staining*	*Adhering calcite*	*Surface erosion*	*Cracking/ flaking*
Boat Cave		X			
Alice and Gwendoline Cave		X	X	X	X
Barntick Cave		X		X	X
Bats' Cave		X	X	X	X
Elderbush Cave		X	X	X	X
Robber's Den		X	X		
The Catacombs		X	X	X	X
Connaberry Cave C		X		X	
Killavullen Cave 3			X		
Killura Cave				X	
Main Earth Cave				X	X
Pollthanacarra		X	X	X	X
Dunkerron Cave			X	X	
Dunmore Cave	X	X	X	X	X
Graineater's Cave		X			
Achill Island Cave				X	
Cave O, Keash				X	
Plunkett Cave, Keash			X	X	
Ballynamintra Cave	?	X	X	X	X
Carrigmurrish Cave			X		
Kilgreany Cave	?	X	X	X	X
Oonaglour Cave		X	X	X	X
Quinlan's Quarry Cave		X	X	X	X

while collagen content was still relatively high and the bone still 'wet', though not necessarily during the immediate post-mortem interval. 'Wet' bone is a lot harder to break than 'dry' or weathered remains; any breaks or fractures present may be the result of deliberate action or may be accidental and secondary to other activities in a cave.

The microclimate of caves is also likely to have influenced the degree of preservation and disarticulation. Although caves offer a high degree of protection from the weather, conditions within them can vary considerably depending on the season. Oonaglour Cave, for example, is subject to flooding during wet months. While limiting access, flooding is also likely to significantly contribute to the disturbance of archaeological deposits as well as disarticulation and dispersal of human remains and other material inside the cave.

Pathologies and anomalies

Although it can be difficult to diagnose specific diseases on disarticulated remains, a number of pathological conditions and anomalies were noted (Table 1.7). The majority were degenerative (Pl. 6) and dental conditions (Pl. 7), as well as micro-trauma to sites of muscle and ligament insertions. Also present were a number of healed fractures as well as traumatic injuries that might be related to activity or work-load (e.g. *os acromiale* and spondylolysis). The majority of these can be interpreted as reflecting lifestyles that were physically demanding. It should be kept in mind that age assessment was difficult as a result of the disarticulated nature of the assemblages and that degenerative joint disease is one of the most frequently diagnosed conditions in archaeological population as it almost inevitably develops with increasing age. Its presence at the cave sites is, therefore, not unusual or surprising, but at the very least indicates that some individuals would probably have been aged at least 30 years or older.

Table 1.7 Overview of main pathologies and anomalies recorded.

Site	*Pathologies and anomalies*
Elderbush Cave	Degenerative joint disease
Robber's Den	Ante-mortem tooth loss; dental abscess; cortical defect (humerus)
Connaberry Cave C	Caries
Pollthanacarra	Enamel hypoplasia; degenerative joint disease; cortical defect (humerus); periarticular erosion
Dunkerron Cave	Degenerative joint disease
Dunmore Cave	Ante-mortem tooth loss; caries; enamel hypoplasia; degenerative joint disease; cribra orbitalia; infection; accidental trauma; cleft vertebral arch
Graineater's Cave	Ante-mortem tooth loss; degenerative joint disease
Cave O, Keash	Cortical defect (tibia)
Ballynamintra Cave	Retained metopic suture
Kilgreany Cave	Ante-mortem tooth loss; dental abscess; enamel hypoplasia; degenerative joint disease; osteoporosis; cribra orbitalia; infection; accidental and non-accidental trauma; cortical defect; enthesopathy
Quinlan's Quarry Cave	Cortical defect (femur; humerus); trauma

Of particular interest are two incidences of intentional trauma from Kilgreany Cave. The first case affected a disarticulated occipital fragment belonging to a juvenile or possibly adolescent individual and consisted of at least two unhealed sharp force injuries (Pl. 5). As the injury affected the back of the head, it would have been inflicted from a posterior position or from above while the victim was lying face-down on the ground. The injuries themselves are not fatal, but the absence of signs of healing indicates that the individual died around the time the wounds were sustained. In the absence of a radiocarbon date, it is difficult to suggest what kind of instrument or weapon could have caused the injuries, but the linearity and well-defined outline of the cuts certainly would have required the use of an extremely sharp and fine-bladed weapon or instrument. Highly magnified scanning electron microscopy images based on detailed casts of the specimens could aid in exploring the exact nature of the injury (e.g. single stroke or repeated cuts) and could provide further detail on the surface properties of the instrument that caused it (Wakely 1997; Orschiedt 1999, 94–95).

The second case was noted on the left mandibular ramus of an adult female skull from Kilgreany ('Kilgreany A') (Pl. 2). The individual had suffered a penetrating injury to the mandible that had partially healed but continued to exhibit a low-grade chronic infection, which evidently affected the individual's ability to move her jaw for eating and speaking (Pl. 9). The pathological changes observed were most likely the result of penetrating sharp force trauma, possibly even a projectile injury caused by an arrowhead. The specimen has been dated to the Neolithic (Dowd 2002) and is important because it confirms the presence of inter-personal violence during this period in Ireland, as well as demonstrating that violence and conflict could affect both sexes. This case also contributes to the debate on the origins of violence and warfare, which has experienced widespread attention in recent years (Keeley 1997; Guilaine and Zammit 2005; Parker Pearson and Thorpe 2005). Even when considering the relative dearth of human remains of prehistoric date from Ireland compared to, for example, the first millennium AD, diagnosis of non-accidental trauma is relatively scarce. A rare published case is presented by an arrowhead found embedded in a pelvic bone and a

healed cranial blunt force injury from the Neolithic portal tomb at Poulnabrone, Co. Clare (Lynch and Ó Donnabháin 1994, 7; Lynch 2014). The arrow injury showed no signs of healing. British examples appear to be more frequent. In their study of British skeletal material, Schulting and Wysocki (2002) demonstrated an overall frequency of 7.4% of non-accidental trauma in a sample of 350 Neolithic crania. Males and females were equally affected. A third of these injuries showed no signs of healing and the majority were the result of blunt force rather than sharp force. Another recent study of 1,012 crania from Neolithic north-west Europe indicated even higher frequencies in some areas of Denmark and Germany, as well as changes in the prevalence and pattern of violence-related head injuries over the course of the European Neolithic (Fibiger 2009; Fibiger *et al*. 2013; Schulting and Fibiger 2012).

Ritual behaviour

Considering ritual behaviour as well as taphonomic factors, two types of assemblages were evident in this study. The small number of bones and low MNI counts at about half of the caves is most probably the immediate result of deliberate depositional practice. These remains could have been brought to caves individually or in small groups, as disarticulated bones rather than fleshed body parts, to play a part in specific ritual activities. Alternatively, they could be the remnants of the use of caves for exposure, excarnation or defleshing of remains, followed by deposition of the majority of the skeleton elsewhere. Although no obvious skeletal evidence for excarnation, such as defleshing cutmarks, has been noted, the use of caves for excarnation may be the reason for the high number of small skeletal elements retrieved from some of them. At the same time, larger skeletal elements may also have been moved by visitors (both human and faunal) to the caves through the ages (Weiss-Krejci 2012).

Larger assemblages are characterised by a higher MNI as well as a wider variety of anatomical elements present. This is more consistent with their interpretation as occasional burial and depositional sites for specific individuals within a community or population group. At Kilgreany and Dunmore, the apparent funerary use of the caves appears to have continued over a period of time, converting them into small cemetery sites for the disposal or deposition of a larger number of individuals during the Neolithic/Bronze Age and early medieval period respectively. Drawing on the accounts of articulated remains at Kilgreany Cave (Tratman 1929; Movius 1935; Dowd 2002), as well as considering the relative good presentation of all four main anatomical regions by weight at both Kilgreany and Dunmore (Table 1.5), it appears likely that burial or deposition of complete, articulated fleshed bodies may have been the predominant burial rite at these sites, though the wide date range for Kilgreany in particular means that the pattern of use and deposition is likely to have changed over time. A combination of natural degenerative processes, animal and human activities, as well as microclimatic factors would have resulted in the disturbance and eventual disarticulation of the majority of remains (Weiss-Krejci 2012).

A small amount of cremated bone (149g) was present at Kilgreany Cave (Pl. 5) and included fragments of an adult cranium, mandible, clavicle, vertebrae, humerus, hand, pelvis, patella, femur and fibula, as well as a juvenile clavicle fragment. When considered as a separate deposit, the remains presented a minimum of two individuals, an adult and a juvenile. The total weight of the cremation deposit, however, does not correspond with the expected bone weight for two individuals. This is a common feature of cremation deposits found in Ireland, which are frequently more consistent with token deposits rather than complete burials (Fibiger 2004). The degree of fragmentation and small size of the Kilgreany deposit did not allow for a more detailed analysis of age or sex. The fissuring and distortion pattern indicated that the remains appeared to have been burned while still fleshed. No other evidence for cremation of human bones was found during the project, indicating that cremation seems to have been a minority rite for cave burials and cave deposits.

Concluding remarks

The analysis of skeletal assemblages from 24 caves in Ireland by the *Human Remains from Irish Caves Project* has allowed for a fresh look at the nature and variety of burial and deposition of human bones in Irish caves. These assemblages are not easily analysed and interpreted osteologically, either individually or as a group. This is primarily a result of the accessibility of these sites from the time of their earliest human and faunal usage up to the present day, which has resulted in continuous disturbance, occasional damage and the removal and reduction of some osteological and artefactual material. Issues of disturbed context and stratigraphy may be partially alleviated through radiocarbon dating. In an Irish context, this has provided a surprisingly broad timeframe for the deposition of human skeletal remains in caves, ranging from the Mesolithic to the post-medieval period (Dowd 2015; see Catalogue below). At the same time, the obvious needs to be emphasised: a radiocarbon date only dates a specific bone, and multi-period sites such as Kilgreany Cave remind us that while the human remains discussed in this chapter and associated catalogue are presented by site, they often represent multiple events, practices and periods. What survives are interesting but incomplete collections of remains, which provide exciting glimpses into the demography and health-profile of past populations. Whether the human remains found in caves represent a

select subset of the living population, and the resulting assemblages were created through deliberate selection or omission, is often difficult to answer osteologically. While Leach (2008) suggests a degree of selection based on particular pathologies for Neolithic cave burials from the Yorkshire Dales, this is not apparent in the Irish cave assemblages. Neither is a clear preference relating to age, as apparent in some Neolithic and Copper Age caves from Portugal (Weiss-Krejci 2012). Some aspects of post-mortem treatment and processing of skeletal remains, especially excarnation, remain osteologically elusive, though this does not oppose the possibility that these practices took place. This study certainly does not aim to present the final word on such issues, and the large number of smaller skeletal elements in a number of caves makes their use for excarnation a viable conjecture.

Caves certainly stand out as otherworldly, dark and silent sites (Dowd 2015), but in terms of fully understanding their osteological assemblages, a broader comparison with non-cave remains presents the next challenge. Despite the limitations outlined above, it is hoped that this discussion of the human skeletal remains from Irish caves provides an impetus for further research and the recognition of the breadth of information to be gained from the systemised recording of disarticulated assemblages and the revaluation of antiquarian excavation material. As more human and faunal skeletal collections from caves and other archaeological sites are analysed based on comparable, reproducible recording methods, the closer we are to moving towards a more informed appreciation and interpretation of the diversity of Irish burial, funerary and ritual practices.

Acknowledgements

The author would like to acknowledge the following: Marion Dowd and Linda Lynch; Angela Boyle; Nigel Monaghan and the curatorial staff of the Natural History Museum; Isabella Mulhall, Mary Cahill, Maeve Sikora and Margaret Lannin of the National Museum of Ireland, Antiquities Division; Sinéad McCartan, Cormac Burke and Michael Simms of the Ulster Museum; Chris Knüsel, University of Bordeaux; Stephanie Leach; Alan Ogden, University of Bradford; Sarah McDowell and Aldara Rico Rey. This project was funded by the Heritage Council under the Archaeology Grant Scheme 2005.

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CATALOGUE OF SITES

Abbreviations used

NMI (AD):	National Museum of Ireland, Antiquities Division, Dublin.
NHM (MS):	Natural History Museum, Merrion Square, Dublin.
NHM (BB):	Natural History Museum, Beggar's Bush, Dublin.
UM:	Ulster Museum, Belfast.
UCC (Arch. Dept.):	University College Cork (Archaeology Department), Cork.

Dental Abbreviations

AMTL:	Ante-mortem tooth loss
U:	Unerupted X: Tooth lost ante-mortem
/:	Tooth lost post-mortem

C: Caries
A: Abscess
C: Calculus
R: Root only present
H: Hypoplasia
B: Broken post-mortem
Con: Congenitally absent
NP: Not present (unobservable)
P: Proximal
B: Buccal
D: Distal
L: Lingual

Permanent Dentition

Right Maxilla	Left Maxilla
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
Right Mandible	Left Mandible

General Abbreviations (CD Appendix 1: Fibiger)

a: Slight
b: Medium
c: Severe
MC: Metacarpal
MT: Metatarsal
UF: Unfused

1. Antrim, Ballintoy Demesne td., Boat Cave
Number of bones: 5
Weight: 19g
Fragment size: 3.1–8.8cm
Description: Five cranial fragments including right frontal, left and right parietal, occipital and left temporal.
MNI: 1 (Neonate/Young Infant)
Age and sex: The remains belonged to a neonate or young infant (size, robusticity).
Colour: Dark yellow to brownish
Condition: Good condition. The only taphonomic change noted were areas of dark staining.
Date: One cranial fragment returned an Iron Age date of 1854±32 BP (UBA-6710) (Dowd 2015, 163).

2. Clare, Ballynahown td., Robber's Den
Disarticulated remains, Second Chamber
Number of bones: 11
Weight: 245g
Fragment size: 2.2–25.5cm
Description: A mandible (removed for dating in 2010), one deciduous tooth, two cranial fragments, a partial left humerus, a right scapula fragment, one thoracic and one lumbar vertebra, a left first rib, a left femoral diaphysis fragment and a right tibial diaphysis fragment.
MNI: 2 (Adult and Juvenile)
Age and sex: Deciduous juvenile tooth representing an individual not older than five years (root development). All other remains appeared to be those of an adult individual (robusticity and epiphyseal fusion). The mandible possibly belonged to an adult female (dental eruption and dental health; mandibular morphology).
Colour: Light yellow to brownish
Condition: Good. The only taphonomic changes were isolated areas of dark staining. Any breaks present appeared to have occurred after a considerable post-mortem interval.
Dental health and anomalies: All 16 tooth positions observed. Dental health good. Eleven teeth had been lost post-mortem. The only changes present were slight calculus deposits on two of the three teeth present. Virtually no dental wear. Slight calculus deposit noted on deciduous incisor. Both third molars appeared to be congenitally absent.
Pathologies and anomalies: The only minor pathology noted was a cortical defect at the insertion of *M. pectoralis major* of the left humerus.
Date: An adult female? The mandible returned an early medieval date of 1210±40 BP (Beta-277382) (Dowd 2015, 184).

Near-complete skeleton, Third Chamber
Number of bones: 72
Weight: 2,212g
Fragment size: 2.2–25.5cm
Description: Cranium and mandible, right scapula and clavicle, left scapula, four cervical, eight thoracic and five lumbar vertebrae, a minimum of four left and four right ribs (some removed for dating in 2002), the left and right humerus, radius and ulna, one left metacarpal, one right metacarpal, one proximal hand phalanx, the left pubis, left and right femur and tibia, left fibula, one left tarsal and two left metatarsals. Also present were a right tibia (removed for dating in 2010) and a proximal fibula of a second individual.
MNI: 2 (Adult)
Age and sex: Majority of remains derived from an adult female (cranial morphology), probably aged over 35 years (dental eruption and dental health; degree of degenerative joint changes). The remains were previously analysed by Catryn Power (1991).
Colour: Light yellow
Condition: Very good. The only taphonomic changes noted were isolated areas of brownish-grey staining and small adhering calcite deposits. Any breaks present appeared to have occurred after a considerable post-mortem interval.

Dental health: All 16 maxillary and 15 mandibular tooth positions observed. Dental health poor. Ten teeth had been lost post-mortem, and three maxillary and three mandibular teeth had been lost ante-mortem. Evidence for two dental abscesses present. Moderate to severe calculus deposits on 13 of the 15 teeth present. Individual also appeared to suffer from periodontal disease. Dental wear was slight to moderate.

xA	C	C	/	X	c		/	x	/		c	/	C	c	c	/
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
/	C	C	x	X	xA	/		/	NP	/	C	C	c	/	C	

Dental pathology: Ante-mortem tooth loss (6/31), dental abscess (2/31), calculus (13/15-moderate to severe), moderate periodontal disease and slight to moderate dental wear.

Pathologies and anomalies: Entheseal changes were noted at the insertion of *M. pectoralis major* on the left humerus. Also present were degenerative changes of the spine. This included vertebral body osteophytosis (C4, T3-4, 7-8 and 10), porosity (C2, 4 and 7, T1 and 7-10) and Schmorl's nodes (T8-9, LV4) as well as vertebral articular facet porosity (L3 and 5). Extra-spinal degenerative joint changes included porosity of the right sterno-clavicular joint, marginal osteophyte formation on one left rib head and the left knee, porosity and marginal osteophyte formation of the right clavicle and gleno-humeral joint and porosity and eburnation (osteoarthritis) of the left glenohumeral joint.

Stature: Calculated based on the regression formula for the left femur (Trotter 1970). This gave a result of 158±3.72cm.

Date: Rib fragments produced a Late Bronze Age/Early Iron Age date of 2490±60 BP (GrN-27381) (Dowd 2015, 127). A right adult tibia returned a medieval date of 320±40 BP (Beta-277383) (*ibid*., 213).

3. Clare, Barntick td., Barntick Cave

Number of bones: 10

Weight: 98g

Fragment size: 1.3–8.6cm

Description: Four cranial fragments, one partial left mandible, one proximal left ulna fragment, one proximal hand phalanx, one left and one unsided femoral fragment and a mandible fragment (removed for dating in 2002).

MNI: 1 (Adult)

Age and sex: All remains appeared to belong to an adult individual (dental development; epiphyseal fusion; size), possibly a male as indicated by the morphology of one occipital fragment.

Colour: Light yellow to brownish

Condition: Moderate condition. Taphonomic changes included areas of dark staining, surface erosion and cracking/flaking. Any breaks present appeared to have occurred after a considerable post-mortem interval.

Dental health: The mandibular fragment presented with one observable tooth position. The tooth present displayed a slight calculus deposit and moderate dental wear.

Date: An adult mandible fragment produced a Neolithic date of 4530±50 BP (GrA-21498) (Dowd 2015, 97).

4. Clare, Cahircalla Beg td., Alice and Gwendoline Cave

Number of bones: 1

Weight: 6g

Fragment size: 4.8cm

Description: One left clavicular diaphysis fragment (removed for dating in 2007). The original assemblage, which cannot be located at present, included phalanges, carpals, metacarpals and arm bones identified at the time of excavation as representing at least one individual, a young adult (Scharff *et al*. 1906, 62–3).

MNI: 1 (Adult)

Age and sex: The remains appeared to belong to an adult individual (size; robusticity).

Colour: Light to darker yellow

Condition: Moderate condition. Taphonomic changes present included areas of dark staining, surface erosion and cracking/flaking. Breaks present appeared to have occurred after a considerable post-mortem interval.

Date: The clavicular diaphysis fragment returned an unsatisfactory date (Dowd 2015, 63).

5. Clare, Edenvale td., the Catacombs

Number of bones: 22

Weight: 627g

Fragment size: 2–23.3cm

Description: A partial cranium (fragment removed for dating in 2002), one thoracic and one lumbar vertebral fragment, three left ribs, a partial right os coxae, one left and one right humeral fragment, one left and one right partial radius (left radius removed for dating in 2007), two partial right ulnae (one removed for dating in 2007 and the other in 2010), one left and one unsided ulnar fragment, four metacarpals, one proximal fibula fragment and two metatarsals. At the time of excavation, the assemblage was said to include a juvenile clavicle and left humerus; and adult remains included a complete skull, cranial fragments, mandible and maxilla fragments, vertebrae, ribs, calcaneus, a humerus, radii, ulnae, metacarpals, fibulae, metatarsals,

phalanges, femora, tibiae, clavicles, scapulae, and a talus. The presence of at least four individuals – three adults and a child – were estimated at that time (Scharff *et al*. 1906, 10, 60–2; unpublished excavation diary, NMI).
MNI: 3 (Adult, Adolescent and Juvenile)
Age and sex: The majority of the surviving remains appear to belong to adult or adolescent individuals (size; epiphyseal fusion; robusticity). Based on the morphology of the partial cranium and the partial right os coxae present, this probably included one male. Juvenile elements present consisted of a partial left radius, a left ulnar fragment, an unsided proximal fibular fragment, a metacarpal and a left metatarsal, all belonging to an individual over three years of age (size).
Colour: Light yellow to brownish-black
Condition: Moderate condition. Taphonomic changes present included areas of dark staining and adhering calcite deposits, surface erosion, cracking and flaking. The majority of breaks present appeared to have occurred after a considerable post-mortem interval. The surface of the proximal break of an ulnar diaphysis was smoother than comparable breaks on other elements in the assemblage, indicating that the bone collagen content might still have been relatively high when the break occurred. However, this did not appear to have taken place peri-mortem but some time after death.
Date: An adolescent ulna returned a Late Bronze Age date of 2488±27 BP (UBA-8150) (Dowd 2015, 127). An adult (male?) cranium and an adult right ulna returned early medieval dates of 1240±50 BP (GrA-22110) and 1160±40 BP (Beta-277394) respectively (*ibid*., 184). A juvenile radius returned a medieval date of 855±24 BP (UBA-8149) (*ibid*., 213).

4. or 5. Clare, Alice and Gwendoline Cave and/or **the Catacombs**

The remains from Alice and Gwendoline Cave and the Catacombs were stored together following the antiquarian excavation. Unfortunately, not all the bones were marked to indicate which cave they came from (EA for Alice and Gwendoline Cave; EC for the Catacombs). The bones described in this section could therefore belong to either cave.
Number of bones: 4
Weight: 29g
Fragment size: 4.5-10.7cm
Description: A partial right clavicle and three ilial fragments
MNI: 1 (Adult) The MNI of one adult applies only when considering the remains as an isolated assemblage. Were they to be added to either the Alice and Gwendoline Cave or the Catacombs assemblages they would not result in any changes to the MNI for those caves.
Age and sex: All remains appeared to belong to an adult individual (size; epiphyseal fusion; robusticity).
Colour: Light yellow to brownish-black
Condition: Moderate condition. Taphonomic changes present included areas of dark staining, adhering calcite deposits, surface erosion and cracking/flaking. Any breaks present appeared to have occurred after a considerable post-mortem interval.

6. Clare, Newhall td., Bats' Cave

In the excavation report the human remains from Bats' Cave and Elderbush Cave were described jointly (Scharff *et al*. 1906). The overall assemblage recorded at that time comprised 150 bones but only 34 of these can be located at present. Unfortunately, not all the bones were marked to indicate which cave they came from (NH1, NH2, NH113–NH151 and NH195–NH222 for Bats' Cave).
Number of bones: 12
Weight: 44g
Fragment size: 1.4–13.3cm
Description: Two scapula fragments (one removed for dating in 2002), one thoracic and one lumbar vertebral body, one unsided rib fragment, one left ulna fragment, two left proximal tibial epiphyses (one removed for dating in 2010), and two unidentified appendicular fragments.
MNI: 3 (Adult/Adolescent, Juvenile, Infant)
Age and sex: The majority of remains appeared to belong to adult or adolescent individuals (size; epiphyseal fusion; robusticity). Juvenile elements present included an unsided rib fragment, two scapula fragments and an unfused proximal tibial diaphysis, belonging to an individual over three years of age (size). Infant remains consisted of one thoracic and one lumbar vertebral body (size; degree of fusion).
Colour: Light yellow to brownish
Condition: Moderate condition. Taphonomic changes present included areas of dark staining, adhering calcite deposits, surface erosion and cracking/flaking. Any breaks present appeared to have occurred after a considerable post-mortem interval.
Date: A juvenile scapula returned a Neolithic date of 4430±50 BP (GrA-21489) (Dowd 2015, 97). An adolescent tibia returned a medieval or post-medieval date of 270±40 BP (Beta-277395) (*ibid*., 213).

7. Clare, Newhall td., Elderbush Cave

In the excavation report the human remains from Bats' Cave and Elderbush Cave were described jointly (Scharff *et al*. 1906). The overall assemblage comprised 150 bones but only 34 bones from both sites can be

located at present. Unfortunately, not all the bones were marked at the time of excavation to indicate which cave they came from (NH3–NH112 and NH156–NH194 for Elderbush Cave).
Number of bones: 20
Weight: 96g
Fragment size: 1.8–11.6cm
Description: A partial left clavicle, one thoracic vertebral fragment, a sacrum, one left rib fragment, two pelvic fragments, one left ulna fragment, two metacarpals (one removed for dating in 2010), seven intermediate hand phalanges, one left proximal tibial fragment, one tarsal and one proximal foot phalanx. An additional adult pelvic fragment was sent for radiocarbon dating in 2002.
MNI: 2 (Adult)
Age and sex: All remains appeared to belong to an adult individual (epiphyseal fusion; size; robusticity). However, the radiocarbon dates indicate the presence of two individuals.
Colour: Light yellow to brownish
Condition: Moderate condition. Taphonomic changes present included areas of dark staining, adhering calcite deposits, surface erosion, cracking and flaking. All breaks present appeared to have occurred after a considerable post-mortem interval.
Pathologies and anomalies Evidence for early degenerative changes of the first sacral vertebra in the form of slight to moderate vertebral body porosity.
Date: An adult pelvic fragment produced a Neolithic date of 4800±50 BP (GrA-24192) (Dowd 2015, 97). An adult right metacarpal 5 was dated to the Late Neolithic–Early Bronze Age 3930±40BP (Beta-277398) (*ibid*., 97).

6. or 7. Clare, Bats' Cave and/or **Elderbush Cave**
In the excavation report the human remains from Bats' Cave and Elderbush Cave were described jointly and not all bones were marked with their own unique excavation code to indicate which site they came from (Scharff *et al*. 1906). The bones described here could therefore belong to either cave.
Number of bones: 2
Weight: 1g
Fragment size: 2.6–2.8cm
Description: A scapular fragment and a right proximal tibial epiphysis.
MNI: 2 (Adult and Juvenile). The MNI of one adult and one juvenile applies only when considering the remains as an isolated assemblage. Were they to be added to either the Bats' Cave or Elderbush Cave assemblage this would have only resulted in a change to the MNI of juveniles at Bats' Cave, adding another individual (juvenile). The adult bone would not have changed the overall MNI of either cave.
Age and sex: The scapular fragment appeared to belong to an adult individual (size; robusticity). Juvenile remains present consisted of a right proximal tibial diaphysis of an individual probably aged over two years (size).
Colour: Light yellow to brownish
Condition: Moderate condition. Taphonomic changes present included cracking and flaking. All breaks present appeared to have occurred after a considerable post-mortem interval.

8. Cork, Ballymacmoy td., Killavullen Cave 3
Number of bones: 25
Weight: 2,657g
Fragment size: 1.1–35.2cm
Description: One cervical, three thoracic and one lumbar vertebrae/vertebral fragments, two rib fragments, one right os coxae, one right ilium fragment (removed for dating in 2004), one proximal ulna fragment, three femoral fragments, one left tibia and one left tibial fragment, five fibular fragments, one left calcaneus, one right talus and three unidentified appendicular fragments.
MNI: 2 (Adult)
Age and sex: All remains appeared to belong to late adolescent or adult individuals (epiphyseal fusion; size; robusticity).
Colour: Light to darker yellow
Condition: Good condition though the majority of elements were virtually encased in calcite. This contributed considerably to the overall weight of the assemblage as well as obscuring most of the bone surfaces (Pls. 3 and 4). Where the original bone surface was visible, taphonomic changes included staining, surface erosion and cracking/flaking. Any breaks present appear to have occurred after a considerable post-mortem interval.
Date: An adult ilium fragment returned a Neolithic date of 4544±39 BP (UBA-6409) (Dowd 2015, 97).

9. Cork, Castlekevin or Killuragh td., Killura Cave
Number of bones: 3
Weight: 31g
Fragment size: 5–7.7cm
Description: One cranial fragment, one right humeral fragment (removed for dating in 2010) and one right metacarpal.
MNI: 1 (Adult)
Age and sex: All remains appeared to be those of an adult individual (size; robusticity).
Colour: Light yellow

Condition: Moderate to good condition. The only taphonomic change noted were small areas of surface erosion. Any breaks present appeared to have occurred after a considerable post-mortem interval.
Date: An adult humerus fragment returned a Neolithic date of 4680±40 BP (Beta-277397) (Dowd 2015, 97).

10. Cork, Connaberry td., Connaberry Cave C
Number of bones: 15
Weight: 78g
Fragment size: 1.6–11.5cm
Description: One partial left maxilla, a right maxilla fragment (removed for dating in 2002), four disarticulated maxillary teeth, two disarticulated mandibular teeth, one partial left scapula, two cervical vertebra (one removed for dating in 2010), one thoracic vertebra, one right metacarpal, one proximal hand phalanx and one metatarsal.
MNI: 2 (Adult)
Age and sex: All remains appeared to belong to an adult individual (dental development; epiphyseal fusion; size). Radiocarbon dates indicated the presence of two individuals.
Colour: Light to darker yellow
Condition: Moderate condition. Taphonomic changes included areas of dark staining and surface erosion. Any breaks present appeared to have occurred after a considerable post-mortem interval.
Dental health and anomalies: The partial left maxilla presented with three observable tooth positions. Only one tooth was preserved *in situ*, displaying slight calculus deposits and slight tooth wear. Of the four disarticulated mandibular teeth, two had slight calculus deposits and one displayed a carious lesion at the cemento-enamel junction. Tooth wear was slight to moderate. Of the two disarticulated mandibular teeth present, one had a slight calculus deposit whereas the other presented with occlusal caries. Virtually no tooth wear was recognisable. The third molar of the left maxilla present appeared to be congenitally absent.
Date: A right maxilla fragment returned a Neolithic date of 4730±50 BP (GrA-22115) (Dowd 2015, 97). An adult cervical vertebrae (C2) returned a medieval date of 470±40 BP (Beta-277399) (*ibid*., 213).

11. Cork, Connaberry td., Main Earth Cave
Number of bones: 1
Weight: 79g
Fragment size: 20.8cm
Description: A right partial tibial diaphysis (part removed for dating in 2005).
MNI: 1 (Adult)
Age and sex: The remains appeared to belong to an adult individual (size).
Colour: Light yellow
Condition: Moderate condition. Taphonomic changes included surface erosion and cracking/flaking. Any breaks present appeared to have occurred after a considerable post-mortem interval.
Date: A tibia fragment returned a medieval date of 306±32 BP (UBA-6678) (Dowd 2015, 213).

12. Fermanagh, Legg td., Pollthanacarra
Number of bones: 137
Weight: 3,364g
Fragment size: 1.8–48.6cm
Description: 25 cranial fragments, 11 disarticulated maxillary teeth, three mandibles, ten disarticulated mandibular teeth, one partial right scapula and two unsided scapular fragments, one partial sacrum, four cervical, seven thoracic and three lumbar vertebrae/vertebral fragments, one hyoid body, one partial right os coxae, three partial left humeri (all three removed for dating in 2007), two partial right humeri, one left and one right humeral fragment, one partial left radius, one left ulna, three left carpals, six left and four right metacarpals, twelve proximal, four intermediate and three distal hand phalanges, one right femur, one partial right and one partial left femur, one left, one right and one unsided femoral fragment, one left and one right tibia, two left and two right fibular fragments, two left and one right tarsal, one left and one right calcaneus, two left and one right talus, two left and four right metatarsals and one proximal foot phalanx.
MNI: 4 (Adult)
Age and sex: All remains appeared to belong to late adolescent or adult individuals (size, robusticity; epiphyseal fusion), including at least two adult males (cranial morphology; femoral and humeral maximum length; femoral head size). One of these appeared to be remarkably tall and robust, indicated by a right femur and left humerus (Table 1.8). Also present was at least one young adult female (cranial morphology; size), recognisable from the morphology of a partial right os coxae, the visible fusion lines on a relatively small and slender right scapula, and the small size of a left femoral head.
Colour: Light yellow to brownish
Condition: Moderate to good condition. Taphonomic changes included areas of dark staining, adhering tufa/calcite deposits, surface erosion and cracking and flaking. Some elements were almost entirely encased in tufa/calcite which contributed noticeably to the overall weight of the assemblage. Any breaks present appeared to have occurred after a considerable post-mortem interval.
Dental health: One partial right maxilla presented with six observable tooth positions. Four teeth had

been lost post-mortem and two teeth were preserved *in situ*, both of which displayed slight calculus deposits and tooth wear. Three complete or partial mandibles were present. The first included 16 observable tooth positions. Eight teeth had been lost post-mortem. Of the eight teeth present, seven displayed slight calculus deposits. Overall, tooth wear was slight to moderate. The second mandible included 14 observable tooth positions. Twelve teeth had been lost post-mortem and only two teeth were present. Calculus was noted on one of these, and tooth wear was slight. The third mandible presented with eight observable tooth positions, but all the teeth had been lost post-mortem. Of the 11 disarticulated maxillary teeth present, nine showed slight calculus deposits. Tooth wear was slight. Of the ten disarticulated mandibular teeth, eight presented with slight to moderate calculus deposits and one displayed linear enamel hypoplastic defects. Again, tooth wear was slight.

Pathologies and anomalies: A minor pathology present was a cortical defect at the insertion of *M. teres major* of one partial right humerus. Also present were degenerative changes on three cervical and three thoracic vertebral bodies as well as on the vertebral facets of one cervical and three thoracic vertebrae, including porosity and osteophytosis. One cervical vertebra also displayed eburnation of the articular facets, pathognomonic of osteoarthritis. In addition, one left humerus presented with slight porosity of the humeral head and circular erosive lesions were present at the femoral head-neck junction of one right femoral head. These are probably indicative of the presence of subchondral cysts.

Metrics:

Table 1.8 Long bone measurements from Pollthanacarra.

Age	*Bone*	*UM reg. no.*	*Max. length (cm)*	*Head diam. (cm)*	*Sex*	*Adult stature*
Adult	L. humerus	K 24297	34.7	5.5	Male	177.3±4.05cm
Adult	R. femur	K 24300	48.6	5.2	Male	177±3.27cm
Adult	R. femur	–	–	4.5	Male	–
Adult	L. femur	K24300	–	4.1	Female?	–
Adult	R. tibia	–	34.1	–	Male?	164.6±3.37cm

Date: The three left humeri all returned Early Bronze Age dates of 3804±34 BP (UBA-8154), 3745±34 BP (UBA-8153) and 3629±37 BP (UBA-8152) (Dowd 2015, 127).

13. Kerry, Dunkerron td., Dunkerron Cave
Number of bones: 6
Weight: 95g
Fragment size: 4.8–10.6cm
Description: Three thoracic and one lumbar vertebra, one unsided rib fragment and one distal radial fragment. One thoracic vertebra (T10 or T11) was removed for dating in 2010.
MNI: 1 (Adult)
Age and sex: All remains appeared to belong to an adult individual (epiphyseal fusion; size/robusticity; degenerative changes).
Colour: Light to darker yellow
Condition: Good condition. Taphonomic changes included surface erosion and adhering calcite deposits. All breaks present appeared to have occurred after a considerable post-mortem interval.
Pathologies and anomalies: The only pathology noted was degenerative changes of the thoracic spine, including vertebral articular facet porosity of one vertebra and a Schmorl's node present on another vertebral body.
Date: A thoracic vertebra produced an early medieval date of 1060±40 BP (Beta-277381) (Dowd 2015, 184).

14. Kilkenny, Mohil td., Dunmore Cave: see Chapter 2, this volume

15. Leitrim, Sramore td., Graineater's Cave (called Sramore Cave in Dowd 2008; Dowd 2015) Number of bones: 3
Weight: 357g
Fragment size: 12.1–30.3cm
Description: A mandible, a right humerus and right femoral diaphysis fragment (part removed for dating in 2004).
MNI: 1 (Adult)
Age and sex: The mandible belonged to an adult individual, possibly male (mandibular morphology) and aged over 20 years (dental eruption). The humerus also belonged to an adult, indicated by the complete fusion of the epiphyses as well as the presence of early degenerative changes of the elbow joint.
Colour: Light to darker yellow

Condition: Condition very good. The only taphonomic changes noted were small areas of dark staining
Dental health: All 16 tooth positions observed. Dental health relatively good. The right medial incisor had been lost ante-mortem and five other teeth had been lost post-mortem. The only other changes were slight to moderate calculus deposits on seven of the ten teeth present. Dental wear severe.
Pathologies and anomalies: Early degenerative joint changes in the form of very mild marginal osteophyte formation present on distal humerus.
Date: A mandibular molar and a femoral fragment returned Late Mesolithic dates of 5227±36 BP (UBA-15772) and 5202± 39 BP (UBA-6407) (Dowd 2015, 82).

16. **Limerick, Knockfennell td., Red Cellar Cave**
Number of bones: 3
Weight: 20g
Fragment size: 2.8–4.7cm
Description: One unsided rib fragment, one proximal foot phalanx and one right talus (removed for dating in 2005).
MNI: 2 (Adult and Juvenile)
Age and sex: The foot bones appeared to be those of an adult individual (size; epiphyseal fusion), whereas the rib fragment belonged to a juvenile (size).
Colour: Brownish
Condition: Good condition. No taphonomic changes noted. The only break present appeared to have occurred after a considerable post-mortem interval.
Date: An adult right talus returned a Neolithic date of 4671±38 BP (UBA-6679) (Dowd 2015, 97).

17. **Mayo, Achill Island (unknown td.), cave Number of bones:** 2
Weight: 56g
Fragment size: 5.1–8.5cm
Description: A left maxilla and left mandible.
MNI: 1 (Adult)
Age and sex: The remains appeared to be those of an adult individual, probably aged under 25 years (dental development).
Colour: Greyish-white
Condition: Moderate condition. Taphonomic changes included surface erosion and an almost bleached greyish-white surface appearance of the bone, probably the result of long-term sea or surface exposure. Breaks present appeared to have occurred after a considerable post-mortem interval.
Pathologies, anomalies and dental health: No pathological changes or anomalies were noted. The partial left maxilla presented with eight observable tooth positions. Four teeth had been lost postmortem. Out of the remaining four teeth, two displayed slight calculus deposits. Tooth wear was slight. A total of thirteen tooth position could be observed on the mandible. Four teeth had been lost post-mortem. Nine teeth were present, eight of which showed slight to moderate calculus deposits.
Date: Unknown.

18. **Sligo, Cloonagh td., Plunkett Cave (Cave P), Keash**
Number of bones: 5
Weight: 31g
Fragment size: 1.5–8.2cm
Description: One mandibular and two maxillary teeth and the distal half of a left humerus. An adult 2nd or 3rd right maxillary molar was removed for dating in 2002.
MNI: 1 (Adult)
Age and sex: All remains appeared to belong to adult individual(s) (dental development; epiphyseal fusion; size).
Colour: Light to darker yellow
Condition: Good to moderate. Taphonomic changes included areas of surface erosion and adhering calcite deposits. Any breaks present appeared to have occurred after a considerable post-mortem interval.
Dental health: The three disarticulated teeth all displayed slight calculus deposits.
Date: An adult maxillary molar returned an early medieval date of 1450±50 BP (GrA-22111) (Dowd 2015, 184).

19. **Sligo, Cloonagh td., Cave O, Keash**
Number of bones: 1
Weight: 97g
Fragment size: 19.1cm
Description: Proximal half of a left tibia (part removed for dating in 2005).
MNI: 1 (Adult)
Age and sex: The remains appeared to be those of an adult individual (epiphyseal fusion).
Colour: Light to darker yellow
Condition: Good. Minimal surface erosion. The break present appeared to have occurred after a considerable post-mortem interval.
Pathologies and anomalies: The only minor pathology noted was a cortical defect at the insertion of *M. soleus*.
Date: A fragment of a tibia returned an early medieval date of 963±33 BP (UBA-6680) (Dowd 2015, 184).

20. **Waterford, Ballinacourty td., Quinlan's Quarry Cave**
Number of bones: 65
Weight: 1,119g
Fragment size: 2–43.2cm
Description: Three cranial fragments, one right and one unsided scapular fragment, four thoracic, one

cervical and five lumbar vertebrae/vertebral fragments (one lumbar removed for dating in 2010), seven left, seven right and one unsided ribs/rib fragments, two right os coxae, one left partial os coxa (removed for dating in 2010), one partial right humerus, one unsided radial fragment, one partial left ulna, two right carpals, one left metacarpal, one proximal hand phalanx, one complete and one partial left femur (removed for dating in 2010), one proximal left fibular fragment, one right talus, eight left metacarpals, eight right metacarpals, two proximal foot phalanges, one distal foot phalanx and two tarsal fragments.
MNI: 3 (2 Adults, 1 Juvenile)
Age and sex: The majority of the remains appeared to belong to adult individuals (epiphyseal fusion; size; robusticity). This included at least one female indicated by the morphology of a pair of pelvic bones. Considering the surface morphology of the auricular surface and the unfused iliac crest, the individual was probably a young adult aged between 18 and 25 years. Further, epiphyseal fusion lines were still clearly distinguishable on a proximal fibula fragment, also indicating the presence of a young adult individual. The presence of a male individual is indicated by the size of a left femoral head. Juvenile remains present consisted of one thoracic vertebral body and three partial lumbar vertebrae. These belonged to an individual aged at least 5 years or older (size, degree of fusion).
Colour: Light yellow to brownish
Condition: Moderate to good. Taphonomic changes included areas of brownish-black staining, adhering calcite deposits, surface erosion and cracking/flaking. All breaks present appeared to have occurred after a considerable post-mortem interval.
Pathologies and anomalies: Minor pathologies noted were two cortical defects, one at the insertion of *M. gluteus maximus* of one left femur and the second at the insertion of *M. pectoralis major* of a partial left humerus. Also present was a case of *os acromiale* of the right scapula. *Os acromiale* is the incomplete bony fusion of the acromion process of the scapula which usually fuses by approximately 20 years (Liberson 1937; Scheuer and Black 2000, 270). Although traditionally it is thought to have a developmental origin, its high prevalence among the skeletal remains of soldiers recovered from the Mary Rose wreck and the combatants from the Battle of Towton indicates that at least in some cases it might present an activity-related skeletal adaptation rather than a developmental defect (Knüsel 2000, 115; Stirland 2000, 121). In those cases, non-fusion of the acromion process would have allowed for a greater range of movements of the shoulder joint.
Date: An adult male left femur returned a Neolithic date of 4920±40 BP (Beta-277392) (Dowd 2015, 97) while an adult female pelvis returned a Bronze Age date of 2990±40 BP (Beta-277391) (*ibid*., 127).

21. Waterford, Ballynamintra Lower td., Ballynamintra Cave
Number of bones: 51
Weight: 405g
Fragment size: 2.4–13.4cm
Description: Three disarticulated mandibular teeth, thirteen cranial fragments, one partial left clavicle, two cervical and two lumbar vertebrae/vertebral fragments, two left ribs/rib fragments, one humeral fragment, two left and one right radial fragment, one left and one right ulnar fragment, three left metacarpals, one proximal hand phalanx, one right femoral fragment, one right patella, one left and four unsided fibular fragments, nine metatarsals and one proximal foot phalanx. A radius was removed for radiocarbon dating in the 1990s (Woodman *et al*. 1997); in 2010 two left adult metatarsals (both MT5) were removed for dating.
MNI: 3 (2 Adult/Adolescent, 1 Juvenile)
Age and sex: The majority of remains appeared to belong to adult or late adolescent individuals (epiphyseal fusion; size/robusticity; dental development). The only juvenile remains present were two metatarsals, representing an individual under ten years of age (size, epiphyseal fusion).
Colour: Light yellow to brownish
Condition: Moderate to poor condition. Taphonomic changes included areas of brownish to black staining, surface erosion, cracking and flaking and adhering calcite deposits. One possible case of rodent activity was noted. Nick-like defects were present along the interosseous border of an adult left ulnar fragment. They strongly resembled the pattern resulting from rodent gnawing, but as the bone had undergone considerable erosion it was not possible to securely identify the defect as rodent-related. One rib was embedded in a calcite deposit which contributed considerably to the overall weight. Any breaks present appeared to have occurred after a considerable post-mortem interval.
Dental health and anomalies: Three disarticulated mandibular teeth were present, each displaying slight calculus deposits and slight dental wear. One first premolar had a bifurcated root, a trait more commonly noted on maxillary molars.
Pathologies and anomalies: A retained metopic suture present on an adult left frontal fragment; this suture usually closes by age four.
Date: A radius returned a Neolithic date of 4230±75 BP (OxA-4250) (Dowd 2015, 97). A left adult metatarsal (MT5) returned a Late Neolithic/Early Bronze Age date of 3930±40 BP (Beta-277385) (*ibid*., 97). A left adult

metatarsal (MT5) returned an Early Bronze Age date of 3720±40 BP (Beta-277384) (*ibid*., 127).

22. Waterford, Ballynamintra Middle td., Carrigmurrish Cave
Number of bones: 2
Weight: 1,915g
Fragment size: 11.8–17.8cm
Description: Complete articulated cranium and mandible (sampled for radiocarbon dating in 2010).
MNI: 1 (Adult)
Age and sex: An adult male (cranial and mandibular morphology), probably aged over 25 years (dental eruption).
Colour: Light yellow
Condition: Very good though both cranium and mandible were partially encased in extensive calcite deposits. As well as obscuring a proportion of the bone surface, these deposits contributed considerably to the overall weight of the skull. The remaining bone surface was clean with a polished appearance.
Dental health: All 32 tooth positions observed; 24 teeth present. Overall, dental health was good. The only changes observed were slight to moderate calculus deposits on 22 teeth. Dental wear was slight.

/	C	c	C	C	C	C	/	/	/	c	c	C	c	c	c
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
c			C	C	C	/	/	/	/	c	c	C	c	c	C

Dental pathology: Calculus (13/15-slight to moderate) and slight dental wear.
Pathologies and anomalies: No other skeletal changes were noted.
Date: The mandible returned a Neolithic date of 4460±40 BP (Beta-277386), though depleted $^{13}C/^{12}C$ ratios in the sample indicate that this date needs to be assessed with caution (Dowd 2015, 97).

23. Waterford, Bridgequarter td., Oonaglour Cave
Number of bones: 74
Weight: 457g
Fragment size: 1–17.8cm
Description: Forty-four cranial fragments, three mandibular fragments, a partial right clavicle, one left scapular fragment, one unsided rib fragment, one left and one right pelvic fragment, eleven left humeral fragments, one proximal right and one unsided radial fragment, two left ulnar fragments, one proximal hand phalanx, one unsided patella, one right tibial fragment, one left talus, one left metatarsal and one proximal foot phalanx. A left proximal radial diaphysis fragment (probably adult) was removed for dating in 2005.
MNI: 2 (Adult and Juvenile)
Age and sex: Virtually all the remains appeared to belong to an adult individual (epiphyseal fusion; robusticity; size; dental development). Only one juvenile element, an unsided patella, was present (size).
Colour: Light yellow to brownish black
Condition: Moderate to poor. Some of the fragments had a soft, almost friable consistency, probably the result of post-excavation treatment in the early twentieth century. This, according to an accompanying note, involved washing and boiling the remains in glue. Taphonomic changes included widespread brownish to black staining, surface erosion, cracking and flaking as well as adhering calcite deposits. The majority of breaks appeared to have occurred after a considerable post-mortem interval. One parietal fragment presented with a well-defined curvilinear break possibly indicating that the bone collagen content had still been relatively high when the damage occurred. However, no endocranial flaking or other endo- or ectocranial changes were present, suggesting that the defect was the result of violent trauma, or had occurred around the time of death.
Dental health: One partial left maxilla presented with three observable tooth positions. Two teeth had been lost post-mortem and only one tooth was present. It showed severe dental wear. No other changes were noted. Another partial right maxilla included one observable tooth position and tooth. No pathological changes were noted. Also present were a mandible with six observable tooth positions. No teeth were actually present; one of the teeth had been lost ante-mortem.
Date: An adult left radial fragment returned a Neolithic date of 4503±38 BP (UBA-6677) (Dowd 2015, 97).

24. Waterford, Kilgreany td., Kilgreany Cave
The archaeological excavation and retrieval of human bones from Kilgreany Cave took place in 1928 and 1934 (Tratman 1929; Movius 1935). Decades of storage in drawers and cardboard boxes has resulted in the mix-up of several of the accompanying cardboard and paper labels indicating find locations. While the contextual and spatial find information for many of the remains is lost, each bone can still be identified as belonging to either the 1928 or 1934 excavation based on the number inked on the bone. In the CD database this is accompanied by information on find location whenever available. It should be noted that not all the individual find numbers assigned by the excavators and referred to in the reports are unique numbers, and multiple use of numbers does occur – possibly indicating bones retrieved from the same location in the cave.

Number of bones: 2,129
Weight: 18,119g
Fragment size: 0.9–40.8cm
Date: Ribs and phalanges of an adult female ('Kilgreany A') produced a Neolithic date of 4580±150 BP (BM-135) (Dowd 2015, 97). A skull fragment and a molar of an adult male ('Kilgreany B') also produced Neolithic dates of 4820±60 BP (Pta-2644) and 4393±45 BP (UBA-15767) (*ibid*., 97). A fragment of a second adult male mandible (Kilgreany 3) was removed for dating in 2002 and returned a Neolithic date of 4790±50 (GrA-21499) (*ibid*., 97). In 2004, the right humerus of a neonate (0–1 months) returned an Early Bronze Age date of 3267±35 BP (UBA-6408) (*ibid*., 127). Four bones were removed for dating in 2010. An infant left humerus (KII 1414) and a left mandible (Kh 453) of a 10–12 year old child both returned Neolithic dates of 4960±40 BP (Beta-277387) and 4450±40 BP (Beta-277388) respectively (*ibid*., 97). A right maxilla (KII 854 B) of a 3–4 year old child and a cremated adult cranial vault fragment (KII 1201) returned Bronze Age dates of 3470±40 BP (Beta-277389) and 3120±40 BP (Beta-277390) respectively (*ibid*., 127).
Colour: Light yellow to brownish
Condition: Although the condition of the remains ranged from good to poor, the majority of elements were in either good or moderate condition. Most breaks present appeared to have occurred after a considerable post-mortem interval. In the case of a left femoral diaphysis fragment, the anterior aspect of the proximal fracture appeared to be relatively smooth. The break might have happened while the collagen content of the remains was still relatively high, but not necessarily peri-mortem. Another break that might have occurred while the bone was still relatively fresh was noted on the distal end of an unsided fibular diaphysis fragment. The fracture outline appeared to be helical and the fracture surface relatively smooth, though part of it was obscured by adhering calcite deposits. One possible case of rodent activity was noted on a right femoral diaphysis fragment, but again surface erosion prevented an accurate assessment of the changes. Other taphonomic changes present included adhering calcite deposits, staining, surface erosion and cracking/flaking.
Cremated bone: Also recorded was a small deposit of cremated bone (149g) (Pl. 5). It was greyish-white in appearance and included fragments of adult cranium, mandible, clavicle, vertebrae, humerus, hand, pelvis, patella, femur and fibula as well as juvenile clavicle. The MNI for the cremated remains is two, including an adult and a juvenile. Fissuring and distortion were present, indicating relatively high cremation temperatures, up to 600°C. The pattern of the fissures on the long bone diaphyses suggested that the remains were burnt while still fleshed, which would be standard practice for the majority of Irish prehistoric cremation burials.
MNI: 21/22 (14/15 Adults, four Juveniles/Adolescents, three Neonates/Infants).
Calculation of the minimum number of individuals at Kilgreany Cave was based on summarising the number of elements present for diagnostic zones of the skull, shoulder, long bones and feet for different age groups (Tables 1.12 and 1.13). For long bones, a large number of epiphyses that are recorded through the zonation method only develop throughout infancy and childhood. They are initially very small and easily displaced, lost or broken. As a result, only those zones in the non-adult remains that were actually represented were listed in the MNI overview.
Based on the left mandible and left talus respectively, a minimum of 21 or 22 individuals were represented by the skeletal remains from Kilgreany (Tables 1.9, 1.10, 1.11). This included 14 or 15 adults (based on the left mandible or left talus respectively), four juveniles/adolescents (based on the left proximal tibia) and three neonates/infants (based on the left proximal tibia).

Table 1.9 Adult MNI from Kilgreany Cave.

Element	*Adult (general) Left*	*Adult (general) Right*	*Male*	*Female*
Petrous temporal	13 12 + Kh 2 (Zone 16)	9 6 + Kh 2 and Kh 65 (Zone 17)		
Maxilla	12 11 + Kh 2 (Zone 12)	13 12 + Kh 2 (Zone 13)	1 (M)	1 (F)
Mandible	15 13 + Kh 2 and Kh 65 (Zone 1)	14 12 + Kh 2 and Kh 65 (Zone 1)	3 (2 M; 1 M?)	3 (2 F; 1 F?)

(Continued)

Table 1.9 Adult MNI from Kilgreany Cave. (Continued)

Element	*Adult (general) Left*	*Adult (general) Right*	*Male*	*Female*
Medial clavicle	6 (Zone 1)	4 (Zone 1)		
Lateral clavicle	11 (Zone 2)	8 (Zone 2)		
Superior glenoid	8 (Zone 2)	4 (Zone 2)		1 (F)
Inferior glenoid	5 (Zone 3)	4 (Zone 3)		1 (F)
Humeral head	2 (Zone 2)	2 (Zone 2)		1 (F)
Deltoid area/humerus	6 (Zone 9)	9 (Zone 9)		
Humeral capitulum	5 (Zone 5)	4 (Zone 5)		
Humeral trochlea	5 (Zone 6)	4 (Zone 6)		
Radial head	3 (Zones 1,2)	4 (Zones 1,2)		
Proximal diaphysis and tuberosity/radius	4 (Zone 5)	5 (Zone 5)		
Olecranon/ulna	8 (Zone 1)	7 (Zone 1)		
Trochlear notch/ulna	9 (Zone 2)	9 (Zone 2)		
Femoral head	6 (Zone 4)	2 (Zone 4)		1 (F)
Gluteus maximus area/femur	8 (Zone 3)	4 (Zone 3)		
Medial condyle and epicondyle/femur	6 (Zone 9)	3 (Zone 9)		
Lateral condyle and epicondyle/femur	7 (Zone 10)	1 (Zone 10)		
Medial proximal condyle/tibia	6 (Zone 1)	2 (Zone 1)		
Lateral proximal condyle/tibia	6 (Zone 2)	2 (Zone 2)		
Medial malleolus/ tibia	3 (Zone 5)	1 (Zone 5)		
Lateral malleolus/ tibia	3 (Zone 6)	3 (Zone 6)		
Fibular proximal epiphysis	4 (Zone 1)	4 (Zone 1)		
Fibular distal epiphysis	5 (Zone 2)	5 (Zone 2)		
Calcaneus	8 (Zone 2)	12 (Zone 2)		
Talus	15 (Zone 2)	12 (Zone 2)		

Table 1.10 Juvenile and adolescent MNI from Kilgreany Cave.

Element	*Juvenile Left*	*Juvenile Right*
Petrous temporal	1 (Zone 16)	2 (Zone 17)
Maxilla	1	1
Mandible	1	1
Medial clavicle	–	1 (Zone 1)
Lateral clavicle	1 (Zone 2)	3 (Zone 2)
Superior glenoid	–	1 (Zone 2)
Inferior glenoid	–	1 (Zone 3)
Humeral head	3 (Zone 2)	–
Deltoid area/humerus	1 (Zone 9)	2 (Zone 9)
Humeral capitulum	–	2 (Zone 5)
Humeral trochlea	–	3 (Zone 6)
Proximal diaphysis and tuberosity/radius	2 (Zone 5)	–
Trochlear notch/ulna	–	3 (Zone 2)
Gluteus maximus area/ femur	1 (Zone 3)	1 (Zone 3)
Medial condyle and epicondyle/ femur	1 (Zone 9)	–
Lateral condyle and epicondyle/ femur	1 (Zone 10)	–
Medial proximal condyle/tibia	4 (Zone 1)	1 (Zone 1)
Lateral proximal condyle/tibia	4 (Zone 2)	1 (Zone 2)
Medial malleolus/tibia	1 (Zone 5)	–
Lateral malleolus/tibia	1 (Zone 6)	–

Table 1.11 Neonate and infant MNI from Kilgreany Cave.

Element	*Infant/Neonate Left*	*Infant/Neonate Right*
Mandible	–	1 (Zone 1)
Lateral clavicle	1 (Zone 2)	–
Deltoid area/humerus	1 (Zone 2)	–
Humeral capitulum	1 (Zone 5)	–
Humeral trochlea	1 (Zone 6)	–
Trochlear notch/ulna	–	2 (Zone 2)
Gluteus maximus area/ femur	2 (Zone 3)	–
Medial proximal condyle/tibia	2 (Zone 1)	3 (Zone 1)
Lateral proximal condyle/tibia	2 (Zone 2)	3 (Zone 2)
Medial malleolus/tibia	2 (Zone 5)	2 (Zone 5)
Lateral malleolus/tibia	2 (Zone 6)	2 (Zone 6)

Table 1.12 Weight of cranial and mandibular bones and bone fragments from Kilgreany Cave.

Element	*Total number present*	*Weight (g)*
Cranial fragments	512	
Disarticulated permanent maxillary teeth	78	3978
Disarticulated deciduous maxillary teeth	5	
Mandibles/mandibular fragments	36	
Disarticulated permanent mandibular teeth	78	490
Disarticulated deciduous mandibular teeth	3	

Two virtually complete articulated skulls (Kh 2 and Kh 65) were present in the cranial/mandibular sample. These specimens will be discussed separately.

Age and sex

Although it was not possible to sex most of the adult remains or ascribe narrow age ranges to the majority of bones, individual elements that could be aged or sexed gave an indication of the representation of different age groups and adult males and females in the sample (Tables 1.14 and 1.15). An equal proportion of males (at least three) and females (at least three) appear to be represented. Only two adults could be aged more specifically, one based on the morphology of the auricular surface and fusion stages of the pelvic epiphyses, the other through considering development and eruption of the third molar. Both were young adults, probably aged between 18 and 25 years. In addition, the degree of spinal and extra-spinal joint disease noted in the assemblage indicates the presence of older

Table 1.13 Post-cranial bones and bone fragments from Kilgreany Cave.

Element	*No. right*	*No. left*	*No. unsided*	*No. total*	*Weight in g*
Clavicle	17	20	3	40	239
Scapula	12	12	8	32	316
Sternum	–	–	–	4	20
Vertebrae	–	–	–	220	1276
Hyoid	–	–	1	1	<1
Ribs	67	65	44	176	358
Pelvis	24	15	25	64	1125
Humerus	24	22	18	64	1194
Radius	13	14	8	35	359
Ulna	28	18	12	58	678
Carpals	12	21	1	34	
Metacarpals	32	34	26	92	
Proximal hand phalanx	–	–	–	88	379 (all hand bones)
Intermediate hand phalanx	–	–	–	35	
Distal hand phalanx	–	–	–	3	
Femur	12	30	29	71	3254 (femur and patella)
Patella	11	3	2	16	
Tibia	13	24	25	62	2123
Fibula	10	12	40	62	563
Tarsals	26	18	–	44	
Metatarsals	50	46	9	105	596 (all foot bones)
Proximal foot phalanx	18	11	21	50	
Distal foot phalanx	–	–	2	2	
Calcaneus	12	8	1	21	582
Talus	12	15	–	27	531
Axial	–	–	3	3	9
Appendicular	–	–	8	8	49

individuals, probably including adults who were at least in their late 30s or 40s. In the sub-adult group, individuals under 1 year of age, neonates, and older infants were present. In the juvenile group, younger individuals aged less than 6 years of age as well as at least one individual aged between 10 and 12 years were recorded.

Dental health

A juvenile left maxilla (Kh 295) presented with five observable deciduous tooth positions. Three teeth had been lost post-mortem. The remaining two teeth displayed slight calculus deposits. Also present was a right juvenile maxilla (KII 854 B), again including five observable deciduous tooth positions. Three teeth had been lost post-mortem and the remaining teeth presented with slight calculus deposits. A complete left and right adult maxilla with 16 observable tooth positions (Kh 160) included six teeth present *in situ*, two of which had slight calculus deposits. Ten teeth had been lost post-mortem. Both third molars present were unerupted and overall tooth wear was slight.

Ten partial or complete left adult maxillae with preserved tooth positions were examined. The first included only one observable tooth position and the tooth had been lost post-mortem. The second left maxilla had two observable tooth positions, but again both teeth were lost post-mortem. The third left maxilla (Kh 158) included eight observable tooth positions. Three teeth appeared to have been lost ante-mortem, whereas the remaining five were lost post-mortem. Also noted was a dental abscess affecting two teeth. The fourth left maxilla (Kh 157) included eight observable tooth positions. Six teeth had been lost post-mortem and the remaining tooth displayed slight calculus. The third molar appeared to be congenitally absent, and tooth wear was slight. The fifth left maxilla (KII 844 X)

Table 1.14 Kilgreany Cave: adult skeletal elements that could be sexed and the method used.

Element	*Registration no.*	*Sex*	*Morphology*	*Metrics*
Left temporal	Kh 25	Female?	X	
Left frontal	Kh 33	Male?	X	
Occipital	Kh 520	Male	X	
Occipital	Kh 515	Male	X	
Occipital	Kh 515	Male	X	
Occipital and right parietal	Kh 517	Female?	X	
Left and right frontal	Kh 517	Male	X	
Left frontal	Kh 517	Female	X	
Right temporal	Kh 517	Female?	X	
Right temporal, occipital and right parietal	Kh 517	Female?	X	
Left temporal	Kh 519	Male	X	
Right temporal	Kh 519	Male?	X	
Left temporal	KII 1123	Female?	X	
Left and right mandible	KII 854 B	Male	X	
Right mandible	Kh 457	Female	X	
Right humeral head	Kh 77	Female		X
Left os coxae	Kh 85	Female?	X	
Right os coxae	Kh 198	Male?	X	
Left os coxae	Kh 22	Female?	X	
Left os coxae	Kh 392	Male	X	
Left os coxae	KII 1259 D	Female?	X	
Left os coxae	KII 898	Male	X	
Right os coxae	KII 898	Female?	X	
Right femoral head	Kh 81	Female		X
Left femur	Kh 82	Female		X
Right femur	KII 898	Male?		X

Table 1.15 Kilgreany Cave: non-adult skeletal elements that could be aged.

Element	*Registration no.*	*Age*
Left mandible	Kh 453	10–12 years
Left maxilla	Kh 295	3–5 years
Right maxilla	KII 854 B	3–4 years
Left and right maxilla	Kh 160	Young Adult? (18–25 years)
Left humerus	KII 1414	6–12 months
Right ulna	KII 1257 G	Neonate
Right ulna	KII 1252 C	Neonate
Left os coxae	KII 898	Young Adult (18–25 years)
Left femur	KII 1265	Neonate
Right tibia	KII 1414	Neonate
Right tibia	KII 1255 DI	Neonate
Left tibia	KII 1280	Neonate

included six observable tooth positions. Four teeth had been lost post-mortem and two teeth were present *in situ*. Both displayed slight to moderate calculus deposits, and dental wear also was slight to moderate. In the case of the sixth left maxilla (KII 1201), eight observable tooth positions were present. No teeth remained, but one tooth had been lost ante-mortem. The seventh left maxilla (KII 914) included five observable tooth positions, but again, all teeth had been lost post-mortem. Three tooth positions were preserved on the eighth left maxilla (KII 914). All teeth had been lost post-mortem. Five tooth positions could be observed on the ninth left maxilla (KII 1240). Three teeth were present, two with slight calculus deposits, and two teeth had been lost postmortem. Dental wear was moderate to severe and one tooth suffered from a dental abscess. Finally, only one tooth position could be observed on the tenth left maxilla (KII 1240). The tooth was present and displayed slight calculus deposits and moderate to severe dental wear.

Also present were nine partial or complete right adult maxillae with observable tooth positions. In the case of the first right maxilla (Kh 202), five tooth positions were recorded. In four cases, the tooth had been lost ante-mortem. For the second right maxilla (Kh 158), six tooth positions could be observed. Four teeth had been lost post-mortem, whereas two teeth were lost during life. Another tooth had suffered from a dental abscess. The third (Kh 162) and fourth (Kh 161) right maxilla included five observable tooth positions each. All teeth had been lost postmortem. The fifth right maxilla (Kh 163) presented with six observable tooth positions. All teeth had been lost ante-mortem. In case of the sixth right maxilla (Kh 416), five observable tooth positions but no teeth were present, and all had been lost post-mortem. Two tooth positions were recorded on the seventh right maxilla (Kh 159). Both teeth were preserved *in situ*, and one displayed a slight calculus deposit. For the eighth maxilla (KII 1240), six tooth positions could be observed. Three teeth were present, one with a slight calculus deposit, and three had been lost postmortem. Eight observable tooth positions were recorded on the ninth right maxilla (KII 874). Five teeth had been lost post-mortem and the remaining three teeth displayed slight calculus deposits. Dental wear was slight.

Of the 83 disarticulated maxillary teeth examined, 72 were fully developed permanent teeth, three were erupted but not fully developed permanent teeth, three were probably unerupted still developing permanent teeth, and five were probably erupted deciduous teeth. Of the 83 maxillary teeth, 61 presented with slight to moderate calculus deposits. Two permanent molars had additional cusps (Carabelli's cusps) and overall dental wear ranged from slight to severe. One permanent right medial incisor had a distinct wear pattern, running inferior-medial to superior-lateral. Although in isolation the origin of this pattern is difficult to assess, it indicates the habitual use of teeth either as a tool or for holding an object.

One partial right mandible of a neonate or young infant (Kh 274) was recorded, but no teeth were present. A juvenile left mandible (Kh 453) included four observable tooth positions of permanent teeth. Two unerupted permanent teeth were present and two teeth had been lost postmortem. One partial mandible (Kh 298) presented with seven observable tooth positions, though all teeth had been lost post-mortem. The second partial mandible (KII 1258 B) included 16 observable tooth positions. Ten teeth had been lost post-mortem. Five teeth were present, two of which had slight to moderate calculus deposits. One tooth had been lost ante-mortem and evidence for two dental abscesses was present. Dental wear was severe. Twelve tooth positions were observable on a third partial mandible (Kh 417), with only one tooth root present. Four teeth had been lost ante-mortem and three dental abscesses were present. Seven teeth had been lost post-mortem. On a fourth partial mandible (KII 854 B), twelve tooth positions were observable. Only one tooth was present, displaying moderate calculus deposits. The remaining teeth had been lost post-mortem.

Eight left and five right partial mandibles/mandibular fragments with observable tooth positions were also present. The first left mandible (Kh 300) included four tooth positions but only one tooth. It displayed slight calculus deposits and had suffered from a dental abscess. The remaining teeth were lost post-mortem. On the second left mandible (Kh 248) four observable tooth positions were present, but all teeth had been lost post-mortem. Three observable tooth positions but no teeth were recorded for the third left mandible (Kh 456). Again, all teeth had been lost postmortem. Five tooth positions could be observed on the fourth left mandible (Kh 455). Three teeth had been lost post-mortem and the two teeth present displayed slight calculus deposits and slight to moderate dental wear. Only two tooth positions and no teeth present were observed for the fifth left mandible (Kh 521). Four observable tooth positions but no teeth were present on the sixth left mandible (KII 1234). In both cases all teeth appeared to have been lost post-mortem. The seventh left mandible (KII 1160 C) included four observable tooth positions. Two teeth, one of which displayed slight calculus deposits, were present and another two had been lost post-mortem. On the eighth left mandible (KII 1201), four tooth positions were present but all teeth had been lost postmortem.

The first right mandible (Kh 244) included four observable tooth positions and three teeth. Two teeth had slight calculus deposits and the third molar was impacted. One tooth had been lost post-mortem. This mandible returned a Neolithic date. For the second right mandible (Kh 454), eight tooth positions and four teeth were present, all of which displayed slight calculus deposits. The third molar appeared to be congenitally absent and dental wear was slight. Three teeth had been lost post-mortem. Six observable tooth positions but no teeth were recorded for the third right mandible (Kh 418). Two of the teeth had been lost ante-mortem, probably as a result of the two dental abscesses present, and the remaining teeth were lost post-mortem. The fourth right mandible included two tooth positions and only one tooth root (Kh 419), the second tooth having been lost post-mortem. Finally, only one tooth position was present on the fifth right mandible (KII 1254 E) but the tooth had been lost post-mortem.

Of the 81 disarticulated mandibular teeth present, 76 were fully developed permanent teeth, one was an erupted but not fully developed permanent tooth, one was an unerupted permanent tooth crown and three were probably erupted deciduous teeth. Of the total, 58 presented with slight to moderate calculus deposits. Two teeth had linear enamel hypoplastic defects, including the erupted but not fully developed permanent tooth. Dental wear ranged from slight to severe.

Summary of dental disease

Due to the disarticulated nature of the Kilgreany Cave remains, comprising individuals from different archaeological periods,

no detailed discussion of the occurrence of dental diseases was attempted. When considering the dental disease summary of permanent teeth present, however, it is interesting to note that caries is completely absent (Table 1.16). Percentage rates for dental abscesses and enamel hypoplasia are relatively low, whereas calculus affected over three quarters of all teeth present. Ante-mortem tooth loss affected just over 10% of observable tooth positions.

Dental anomalies

Carabelli's cusps, congenitally absent or impacted molars, and supernumerary teeth are a relatively common finding during osteological analysis of larger skeletal assemblages (Table 1.17). The wear pattern of a right maxillary incisor indicates the possible use of teeth as tools, but without the remaining dentition this cannot be assessed further.

Pathologies and anomalies

Degenerative Joint Disease (DJD)

Spinal Degenerative Joint Disease

A total of 207 adult and 13 juvenile and infant vertebrae and vertebral fragments were recorded. This included 60 cervical, 97 thoracic, 39 lumbar and 24 sacral vertebrae and vertebral fragments (Table 1.18).

Degenerative changes noted in the adult assemblage included osteophytosis, porosity and Schmorl's nodes for vertebral bodies; and osteophytosis, porosity and eburnation for vertebral articular facets (Table 1.19; Pl. 6).

Again, it should be emphasised that the zonation method will record the presence of a given zone even if it is only partially represented. For the calculation of joint disease, frequencies will mean a possible overestimation of available observable joint surfaces. Bearing these limitations in mind, however, calculations based on these figures will still result in a valuable indication of the distribution of degenerative changes over the various spinal segments and extra-spinal joints.

Cervical vertebrae are characterised by the highest degree of mobility within the spine regarding flexion, extension and rotation. The lower spinal segments, especially the lumbar spine, consist of larger vertebrae with a lesser degree of mobility and are primarily designed as weight-bearing elements. Although degenerative joint changes are to a large extent age-related, their distribution can give an indication of different levels of habitual or strenuous movements affecting different joints within a population.

An overview of the approximate percentage frequencies for different changes shows that degenerative changes of vertebral bodies appeared to be highest in the lower spine (lumbar and sacral segments), followed closely by the neck region (cervical segment) (Table 1.20). Overall, figures for the thoracic region were comparatively low. Considering vertebral articular facets, overall figures were lower than for vertebral bodies. The highest percentage of degenerative changes was recorded for the cervical spine, followed by the lumbar region. Again, figures for the thoracic spine were comparatively low. As the assemblage only consists of isolated, disarticulated remains only, which had probably built up over a considerable period of time, no further conclusions could be drawn.

Extra-spinal DJD

Mandible: The right mandibular fossa of one temporal bone out of 14 right temporal bones present (7.1%) showed evidence for osteophytosis.

Table 1.16 Dental disease (permanent teeth) from Kilgreany Cave.

	Teeth present	*Observable tooth positions*	*Ante-mortem tooth loss*	*Post-mortem tooth loss*	*Calculus*	*Dental abscess*	*Dental enamel hypoplasia*
Maxilla	97	111	16	73	74	4	0
Mandible	98	98	7	70	86	8	2

Table 1.17 Dental anomalies from Kilgreany Cave.

Registration no.	*Anatomical element*	*Anomaly present*
Kh 160	Left maxilla	Supernumerary tooth behind left medial incisor
KII 914	Left maxillary 1st molar	Carabelli's cusp
KII 914	Right maxillary 1st molar	Carabelli's cusp
Kh 157	Left maxilla	3rd molar congenitally absent
Kh 244	Right mandible	Impacted 3rd molar
Kh 454	Right mandible	3rd molar congenitally absent
KII 914	Right medial maxillary incisor	Unusual wear pattern

Table 1.18 Summary of spinal elements present at Kilgreany Cave.

Spinal segment	*Vertebral body (Zone 1)*	*Right transverse process and articular facets (Zone 2)*	*Left transverse process and articular facets (Zone 3)*	*Spinous process (Zone 4)*
Cervical	43	28	35	23
Thoracic	64	60	44	42
Lumbar	30	22	21	14
1st sacral vertebra	8	4	3	–

Table 1.19 Summary of adult elements affected by spinal DJD from Kilgreany Cave.

Spinal region	*Osteophytosis*	*Porosity*	*Schmorl's nodes*	*Eburnation*
Cervical vertebral bodies	10	8	–	–
Thoracic vertebral bodies	2	6	3	–
Lumbar vertebral bodies	6	7	3	–
1st sacral vertebral body	3	3	1	–
Cervical articular facets	5	5	–	1
Thoracic articular facets	1	1	–	–
Lumbar articular facets	2	2	–	1
1st sacral vertebra articular facets	–	–	–	–

Table 1.20 Adult spinal DJD percentages from Kilgreany Cave.

Spinal region	*Osteophytosis*	*Porosity*	*Schmorl's nodes*	*Eburnation*
Cervical vertebral bodies	23.2%	18.6%	–	–
Thoracic vertebral bodies	3.1%	9.3%	4.6%	–
Lumbar vertebral bodies	20%	23.3%	10%	–
1st sacral vertebral body	37.5%	37.5%	12.5%	–
Cervical articular facets	14.2–17.8%	14.2–17.8%	–	2.8–3.5%
Thoracic articular facets	1.6–2.2%	1.6–2.2%	–	–
Lumbar articular facets	9– 9.5%	9–9.5%	–	4.5–4.7%
1st sacral vertebra articular facets	–	–	–	–

Clavicles: A total of 40 clavicular fragments were present: 19 left, 12 right and three unsided adult; one left and four right juvenile; and one right infant. Degenerative joint changes in the form of porosity or marginal osteophyte formation affected the acromial aspect of two out of a total of 14 left adult acromial zones present (14%), and one out of nine right adult acromial zones present (11.1%).

Scapula: A total of 32 scapular fragments were present: 12 left, 10 right and eight unsided adult; and two right juvenile. No degenerative joint changes were recorded.

Ribs: A total of 176 adult ribs and rib fragments were recorded: 61 left, 58 right and 40 unsided adult/adolescent; three left, three right and four unsided juvenile; and three left and four right infant. The only degenerative changes noted in the adult sample were one incidence of porosity of a right rib head out of 18 observable right ribs heads present (5.5%) and one case of osteophytosis of a right costal facet out of 31 observable costal facets present (3.2%).

Pelvis: A total of 64 pelvic fragments were examined: 20 left, 13 right and 22 unsided adult; three left, two right and three unsided juvenile; and one left infant. No degenerative changes of the hip joint were recorded for any of the zones including acetabular regions in the adult sample.

Humerus: A total of 64 humeri and humeral fragments were recorded: 17 left, 14 right and 17 unsided adult; six left, eight right and one unsided juvenile/adolescent; and one left infant. No degenerative joint changes were present.

Radius: A total of 35 radial fragments were recorded: ten left, 13 right and six unsided adult; and three left, one right and two unsided juvenile/adolescent. One right distal adult radius showed degenerative changes in the form of osteophytosis, but these appeared to have developed secondary to trauma and will be discussed below.

Ulna: A total of 58 partial ulnae and ulnar fragments were examined: 18 left, 22 right and 11 unsided adult; four right and one unsided juvenile/adolescent; and two right neonate. Degenerative joint changes in the form of marginal osteophytosis and porosity affected the distal aspect of one partial left ulna out of nine recorded left distal zones (Zone 7 and 8) (11.1%) and one right partial ulna out of seven recorded distal zones (14.2%).

Hand: A total of 252 hand bones and bone fragments were present. This included 12 left, 21 right and one unsided adult carpals. In addition, there were 33 left, 31 right and 22 unsided adult and one left, one right and four unsided juvenile/adolescent metacarpals or metacarpal fragments. A total of 79 proximal, 34 intermediate and three distal adult; eight proximal and one intermediate juvenile/adolescent; and one infant hand phalanges/fragments were recorded. Degenerative changes in the form of eburnation were noted on the articular surfaces of one of the 12 left metacarpals (8.3%) and one of the 21 right metacarpals (4.7%). Three of the 26 (11.5%) observable left and one of the 28 (3.6%) observable right proximal metacarpals presented with degenerative changes including osteophytosis, porosity, eburnation and joint contour change. One of the 22 observable distal left metacarpals (4.5%) also showed degenerative changes including osteophytosis, porosity and joint contour change. Of the hand phalanges present, only one of the 33 observable intermediate adult hand phalanges was affected by joint disease of the distal surface (3%). It displayed gross degenerative changes including osteophytosis, porosity, eburnation and joint contour change.

Femur: A total of 71 femora and femoral fragments were examined: 24 left, ten right and 28 unsided adult; two left, two right and one unsided juvenile/adolescent; and four left infant. The only degenerative change noted was the presence of porosity on one possible right femoral head out of a total of three right femoral heads present (33.3%).

Patella: A total of 16 patellae and patella fragments were present: three left, 11 right and two unsided adult. No degenerative joint changes were noted.

Tibia: A total of 62 tibiae and tibial fragments were analysed: 18 left, nine right and 24 unsided adult; five left, one right and one unsided juvenile/adolescent; and one left and three right infant. No degenerative joint changes were noted.

Fibula: A total of 62 fibulae and fibular fragments were recorded: 12 left, ten right and 40 unsided adult/adolescent. No degenerative joint changes were noted.

Table 1.21 Adult extra-spinal joint disease present at Kilgreany Cave.

Bone	*Left*	*Right*
Mandibular fossa of temporal	No DJD present	1/14 (7.1%)
Lateral clavicle	2/14 (14%)	1/9 (11.1%)
Rib head	No DJD present	1/18 (5.5%)
Rib costal facet	No DJD present	1/31 (3.2%)
Distal ulna	1/9 (11.1%)	1/7 (14.2%)
Carpal	1/12 (8.3%)	1/21 (4.7%)
Proximal metacarpal	3/26 (11.5%)	1/28 (3.5%)
Distal metacarpal	1/22 (4.5%)	No DJD present
Distal intermediate hand phalanx	1/33 (unsided) (3%)	No DJD present
Proximal femur	No DJD present	1/3 (33.3%)
Talus	No DJD present	1/12 (8.3%)
Distal metatarsal	1/25 (4%)	No DJD present

Foot: A total of 249 foot bones and bone fragments were present. This included 15 left and 12 right adult tali. In addition there were eight left, 12 right and one unsided adult calcanei; plus 18 left and 26 right adult tarsals. Also recorded were 41 left, 46 right and eight unsided adult metatarsals; and five left, four right and one unsided juvenile/adolescent metatarsals. A total of 46 proximal and two distal adult foot phalanges and four proximal juvenile/adolescent foot phalanges were included. The only degenerative joint change noted was osteophytosis of one right talus out of a total of 12 present (8.3%). Another condition recognised was a periarticular erosive defect present at the distal end of a left second metatarsal out of a total of 25 observable distal metatarsals present (4%). It is probably the result of an erosive arthropathy or joint inflammation.

Summary of extra-spinal DJD

Relatively little evidence for extra-spinal degenerative joint disease was found at Kilgreany Cave, and the majority of cases were present in the wrist or hand region (Table 1.21). This is not surprising in view of several

factors. Although hand and wrist bones are the smallest contributors to the overall weight of the assemblage, they were the second most commonly retrieved element at Kilgreany Cave when considering overall number of bones and bone fragments (Figs. 1.3 and 1.4). In addition, probably due to their small size but relatively robust structure, wrist and hand bones appeared to have survived relatively intact, thus providing a disproportionate number of observable joint surfaces when compared to long bones and bones of the shoulder and pelvis. On a biomechanical level, hand and wrist will be involved in a multitude of everyday habitual as well as strenuous activities throughout life and degenerative changes would be expected in most populations.

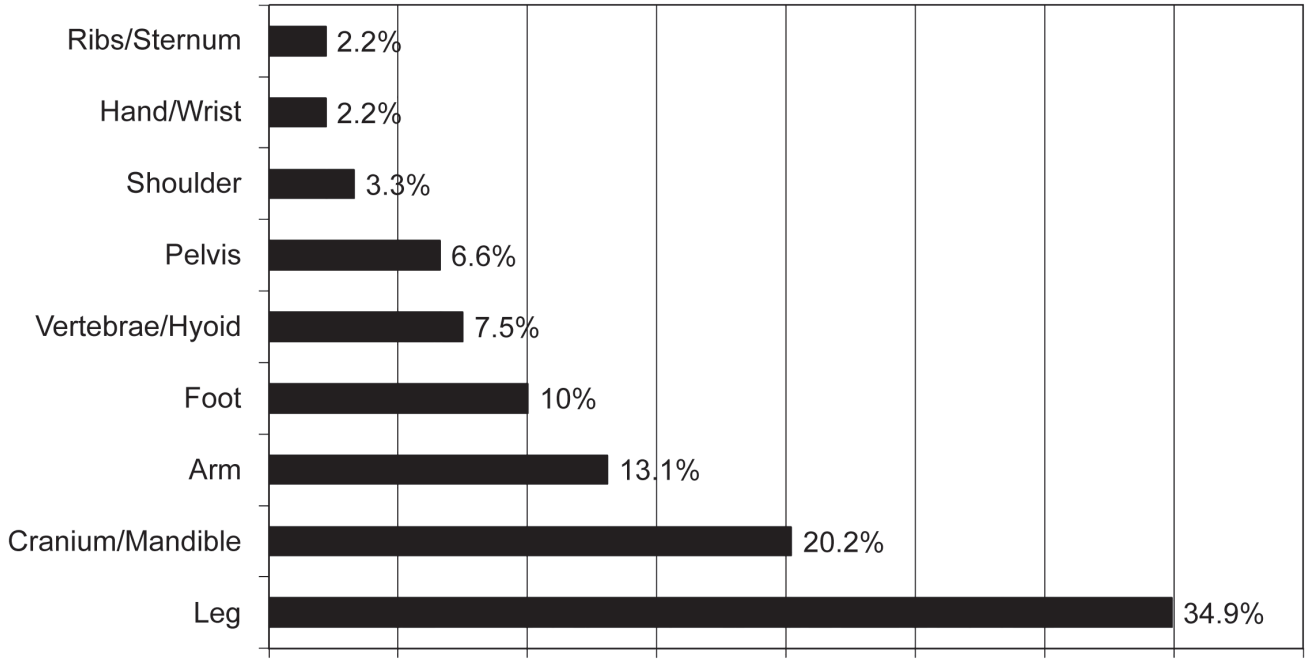

Figure 1.3 Representation of anatomical regions from Kilgreany Cave by bone weights.

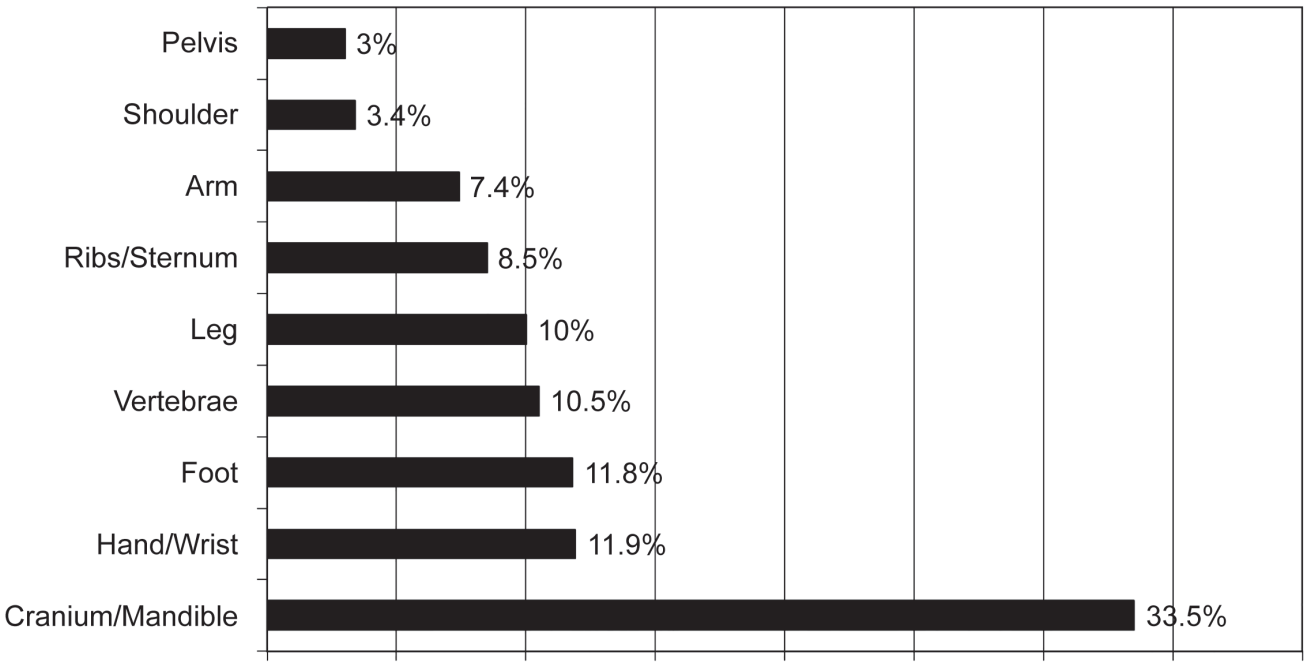

Figure 1.4 Representation of anatomical regions from Kilgreany Cave by number of fragments present.

Metabolic disease

One partial left frontal of a possible female individual (Kh 517) displayed healed cribra orbitalia (Type II) of the left orbit.

Osteoporosis

A first lumbar vertebra (Kh 403) presented with collapse of the superior and inferior vertebral body surface and significant anterior compression of the body. This type of lesion is typically found in cases of senile osteoporosis.

Infectious disease

One occipital fragment (Kh 515) displayed an area of ecto-cranial porosity, which could be related to either a localised irritation or inflammation of the overlying soft tissue, or indicate the presence of a more systemic condition such as a metabolic disorder. A network of capillary erosive lesions was present on the endo-cranial aspect of another occipital fragment (Kh 517). Some lesions had a vascularised appearance bridged by new bone formation; others were deeper, more extensive and irregular in shape. These are indicative of a relatively long-standing systemic condition, possibly an inflammation or infection. A possible perforating, erosive defect was present in the glabella area of a frontal fragment (KII 1240). As the area had suffered extensive surface erosion, it is difficult to determine whether the lesion is a post-mortem effect or related to a pathological condition present during life. Extensive sinusitis can result in similar defects when untreated, presenting a possible differential diagnosis. A circular lytic defect was present on the ecto-cranial aspect of an unidentified cranial fragment (KII 1336). The lesion had a trabecular floor and was possibly the result of an infectious condition.

Trauma

A juvenile or adolescent occipital fragment (Kh 515) presented with at least two peri-mortem sharp force injuries (Pl. 8). A superficial cut extended horizontally across the fragment, measuring 0.7cm in maximum length. The superior edge was smooth and polished and the inferior edge irregular. Another defect was present at the inferior extent of the fragment. Only the superior, smooth margin of this wound was preserved and the injury would have extended beyond the preserved fragment. A third superficial cut was noted superior to the first wound. It measured 0.6cm in maximum length and again would have extended beyond the preserved fragment. This latter defect, however, could not be positively assessed as peri-mortem. The cuts are all well-defined and appear to have been created by a very sharp and yet fine-bladed instrument. One unidentified cranial fragment presented with a rather well-defined curvilinear break suggesting that the defect occurred while the bone collagen content was still relatively high. Preservation of the fragment was poor, though the presence of some endo-cranial flaking indicates that the break might have occurred peri-mortem.

A fifth lumbar vertebra (Kh 281) presented with a possible case of Scheuermann's disease, although post-mortem damage makes a secure diagnosis difficult. The anterior half of the superior body had a grossly porous, step-like defect common for the condition. An alternative diagnosis is spondylolysis with accompanying spondylolisthesis of the overlying vertebrae. Slipping of the adjacent vertebral body can result in gross changes to the anterior-superior aspect of the vertebral body below.

One possible healed fracture of a right radius was present (Kh 79). The distal end of the bone presented with a slight posterior curvature and thickening of the distal diaphysis due to deposits of remodelled compact bone. Secondary degenerative changes (osteophytosis) were also present. The changes are compatible with those resulting from a Smith's fracture which in a clinical context occurs predominantly in young males. This type of fracture of the distal forearm is caused by a fall or blow on the back of the flexed wrist (Salter 1999, 573). Another healed fracture recorded involved both bones of the forearm. An unsided juvenile distal radial and ulna diaphysis fragment appeared to have suffered a diaphyseal fracture that resulted in the displacement of the radial shaft fragment. Both diaphyseal fragments were embedded in a substantial ossified callus. An adult right ulna presented with what appeared to be a healed fracture of the styloid process, which had also resulted in secondary degenerative joint disease, characterised by marginal osteophytosis and porosity of the joint surface.

A possible healed fracture was noted on a partial left adult metacarpal (Kh 275), which had been broken mid-shaft. Thickening as a result of a remodelled new bone deposit as well as a slight angulation of the diaphysis were visible at the break. They are most likely the result of a healed ante-mortem fracture. Another possible healed fracture affected an adult proximal hand phalanx (Kh 205). Again, pronounced thickening due to the presence of remodelled new bone was present at midshaft. This deposit had a smooth surface and was continuous with the original bone surface, indicating longstanding healing of the injury. A healed fracture of the proximal diaphysis was present on a right partial fibula (Kh 333). The ossified callus had fused the fibular and proximal tibial diaphyses.

Entheseal changes and cortical defects

Cortical defects were noted on six elements. The first was recorded at the insertion of the costoclavicular ligament of a right partial adult clavicle. Another was present at the insertion of *M. latissimus dorsi* of a right partial adult

humerus (KII 1201). A right partial adult femur (KII 1257 G) presented with a cortical defect at the insertion of *M. gluteus maximus*. Two partial left tibiae had cortical defects at the insertion of *M. soleus* (KII 854 B; KII 898) and a right distal fibular fragment (KII 914) presented with a cortical defect at the insertion of the interosseous ligament. Entheseal changes were present at the insertion of *M. gluteus maximus* of a left partial femur (KII 722).

Metrics

The available long bone measurement have been summarised in Table 1.22.

Kilgreany skulls: 'Kilgreany A' and 'Kilgreany B'

Two articulated skulls (Pl. 2) in the assemblage, 'Kilgreany A' and 'Kilgreany B', had originally been part of two crouched burials excavated in the cave in 1928 and both were later radiocarbon dated to the Neolithic (Tratman 1929; Dowd 2002; Dowd 2015, 97). Unfortunately, following the excavation the skeletons were not stored separately but mixed together with all the other human remains retrieved from the site. It was thus not possible to attribute any post-cranial remains to these skulls.

'Kilgreany B' (Kh 2)

Human remains analysed included a virtually complete cranium and mandible (total weight 612g) representing an adult male (cranial and mandibular morphology), probably aged over 25 years (dental eruption and dental health). The remains were light yellow in colour and were in moderate to good condition. Taphonomic changes noted included small areas of dark staining, adhering calcite deposits, occasional surface erosion and some cracking/flaking. Parts of the skull were glued and reconstructed with red, putty-like material, which contributed to the overall weight of the bone. Breaks present appeared to have occurred after a considerable post-mortem interval.

All 16 maxillary and 16 mandibular tooth positions could be observed. Dental health was rather poor. A total of 24 teeth were present. Four maxillary teeth had been lost ante-mortem and one maxillary and one mandibular dental abscess were present (Pl. 7). Slight calculus deposits were noted on 15 of the 24 teeth present. Dental wear was severe.

Dentition:

/		c	x	X	R	/	R	x	x	c	/	RAc	c	c	
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
C	RA			C	C	c	c	/	c	c	c	c		c	

Dental pathology: Ante-mortem tooth loss (4/32), dental abscess (2/32), calculus (15/24-slight) and severe dental wear.

In his original analysis of the remains, Fawcett (1928, 129) diagnosed the presence of healed blunt force trauma on the cranium of Kilgreany B. On re-examining the

Table 1.22 Kilgreany Cave long bone measurements.

Age	*Bone*	*Reg. no.*	*Max. length (cm)*	*Head diam. (cm)*	*Sex*	*Adult stature*
Adult	Right humerus	Kh 77	27.8	3.7	Female	151.4±4.45cm
Adult	Right humerus	KII 1201	–	4.3	?	–
Infant	Left humerus	KII 1414	9.2	–	–	–
Adult	Left ulna	Kh 6	26.7	–	?	–
Juvenile	Right ulna	KII 1396	7.7	–	–	–
Neonate	Right ulna	KII 1257 G	6.2	–	–	–
Neonate	Right ulna	KII 1252 C	6	–	–	–
Adult	Right femur	Kh 81	–	3.9	Female	–
Adult	Left femur	Kh 82	40.8	3.9	Female	154.9±3.72cm
Adult	Right femur	KII 898	45	–	Male?	168.5±3.27cm
Neonate	Left femur	KII 1265	7.58	–	–	–
Adult	Right tibia	Kh 74	33.9	–	?	–
Neonate	Right tibia	KII 1414	6.54	–	–	–
Neonate	Right tibia	KII 1255 DI	6.41	–	–	–
Neonate	Left tibia	KII 1280	6.32	–	–	–
Adult	Left fibula	Kh 75	32.8	–	?	–

remains, this diagnosis was found to be highly uncertain. What Fawcett describes as a 'comma-shaped' depression, on reexamination measures 5.8cm × 3.1cm in maximum extent and 0.5–1.2mm in maximum depth, and appears to be present on the left posterior frontal and anterior parietal region. However, the area has suffered extensive and highly irregular surface erosion, which is contributing disproportionately to the optical impression of a dip in the cranial surface. Furthermore, the depression is not noticeable on the endocranial aspect of the specimen. Based on these observations, the changes are more likely to be of a taphonomic rather than a traumatic origin.

'Kilgreany A' (Kh 65)

Human remains analysed comprised a relatively complete cranium (including frontal, left and right parietal, occipital, right temporal, right sphenoid and right zygomatic) and mandible (total weight 317g) representing an adult female (cranial and mandibular morphology), probably aged over 25 years (dental eruption and dental health). The remains were light yellow in colour and were in moderate to good condition. Taphonomic changes noted included small areas of dark staining, adhering calcite deposits, occasional surface erosion and some cracking/flaking. Parts of the skull were glued and reconstructed with red, putty-like material, which contributed to the overall weight of the bone. In addition, the mandible was glued to the cranium. Breaks present appeared to have occurred after a considerable post-mortem interval.

Sixteen mandibular tooth positions could be observed. Seven teeth had been lost ante-mortem and only five teeth were present. Slight calculus deposits were noted on three teeth and tooth wear was severe. The right third mandibular molar appeared to be congenitally absent.

Dentition:

8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Con	X	x	x	/	/	c	c	/	c	R	R	x	x	X	x

Dental pathology: Ante-mortem tooth loss (7/15), calculus (3/5-slight) and severe dental wear.

A well-healed, perforating traumatic injury was present on the left mandibular ramus (Pl. 9). The perforating defect was noted at the anterior extent of the ramus-body angle. It measured 1.4cm in inferior-superior direction and 0.5cm in medio-lateral direction. A small slice of bone appeared to have been separated during the injury at its superior extent. During the healing phase of the wound, it fused again with the remaining mandibular ramus in a slightly overlapping fashion. Remodelling of the bone surface is evident on the external anterior half of the ramus, indicated by some faint porosity or pitting. Sinuses are present at the primary point of injury as well as at the superior external extent of the mandibular ramus. The left coronoid process is underdeveloped compared to the right side. Minimum ramus breadth is visibly smaller on the left.

According to the initial osteological report completed by Fawcett (1928), the mandibular changes present are the result of a dental abscess originating in the third molar region. Even though abscesses can lead to extensive infectious changes of the bone surrounding the affected tooth, such as the remodelling and pitting seen on Kh 65, this cannot account for the overlapping segment of bone along the anterior ramus. This is clearly a traumatic injury which had become infected but partially healed. Most likely it was caused by horizontal penetration with a sharp object from a lateral or slightly posterior-lateral direction. Removal of the blade appears to have caused the vertical crack along the mandibular ramus. Although the injury appeared to have healed slowly, evidence for chronic low-grade infection is evident in the sinus near the mandibular notch. Apart from the obvious damage to the bony part of the mandible, it would also have affected and possibly permanently impaired the overlying muscular and nervous tissue, such as *M. masseter*, which is essential for movement of the jaw and cheeks during chewing and speaking. Permanent damage to some of the mechanical functions of this region would also account for the atrophy of the left mandibular ramus.